PROJECT AND JOURNAL ARTICLE WRITING

FOR AGRICULTURAL SCIENCE AND RELATED DISCIPLINES

Ibrahim Hayatu Kubkomawa

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This book is dedicated to

my parents, brothers, sisters

and

the entire Lala Communities

in Nigeria and the Diaspora

About the Author

Ibrahim Hayatu Kubkomawa was born on 18th April 1975 at Kwargashe Village of Lala District, Gombi Local Government Area of Adamawa State, Nigeria. He is a devoted Christian and Lala by tribe. He attended Fotta Primary School from 1983 to 1989; General Murtala Mohammed College (G.M.M.C) Yola, from 1989 to 1994. He proceeded to the Federal University of Technology Yola, (FUTY) now Modibo Adama University of Technology (MAUTECH) Yola where he obtained B. Tech. (Hons) Animal Science and Range Management with Second Class Upper Division in 2002. He was deployed for his National Youth Service Corps (NYSC) to Alu Community High School, Alu, Kogi State. During his service year, he distinguished himself and served selflessly and meritoriously, which earned him a state NYSC award of commendation as a dedicated and committed corps member of 2002. He holds a Certificate in Computer Application and Techniques with WISEMATE Nig. Ltd., Ikoyi Lagos in 2006; Certificate in Computer Appreciation and Applications with Impact and Associates (Management Consultants) Maiduguri, Borno State in Collaboration with Skisoft Systems Consultants Ltd., 2009.

He also holds a Master's Degree in Animal Production and Management from Federal University of Technology Yola in 2011. He is also a Ph.D student with the Department of Animal Science and Technology, Federal University of Technology, P. M. B. 1526, Owerri, Imo State, Nigeria. He is a Registered Animal Scientist (RAS), a full member of the Nigerian Institute of Animal Science (NIAS) and Animal Science Association of Nigeria (ASAN). He has thirty one (31) published articles in reputable local and international journals across the world. He has also attended many workshops and conferences of international renown. He has taught in Adamawa State College of Agriculture, Mubi between 2003 and 2007 and is currently a Lecturer with the Department of Animal Health and Production Technology, The Federal Polytechnic, P. M. B. 35, Mubi, Adamawa State, Nigeria. The author's hobbies include: reading, writing, traveling, listening to gospel music, meeting and helping people. His likes include: appreciating beauty of nature, honesty, hard work and respect for people.

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My greatest thanks go to Almighty God, to Him be the glory for giving me the inspiration, zeal, vision and understanding to successfully compile this research guide.

I sincerely also wish to express my profound gratitude and unreserved appreciation to Professor Igwebuike, J. U., Department of Animal Science University of Maiduguri, Borno State, Nigeria, Neils J. Shelleng (PhD), Department of Animal Production, Adamawa State University Mubi, Adamawa State, Nigeria, Mr. and Mrs. Lanre, Department of Agricultural Technology, The Federal Polytechnic P.M.B. 35, Mubi, Adamawa State Nigeria for their open minded and selfless dedication towards reviewing the manuscript and making valuable corrections which led to the actualization of this book.

My sincere gratitude also go to W. D. Nafarnda (PhD), Faculty of Veterinary Medicine, University of Abuja, Abuja, Nigeria, M. A. Tizhe (PhD), Dr. Nafisatu Abubakar, Department of Animal Health and Production Technology, The Federal Polytechnic, P.M.B. 35, Mubi Adamawa State and Ifeanyi Charles Okoli(PhD), Department of Animal Science and Technology, Federal University of Technology P. M. B. 1526,Owerri, Imo State, Nigeria, for their all-time encouragement and counseling throughout my career as a prolific writer in the academic environment. I also wish to remember my brother Da'ajabiu E. K. Micah, L. C. C. N. Shall-Holma Diocese, Gombi, Adamawa State, for his continued encouragement and support.

Foreword

Ifeanyi Charles Okoli (DVM, MSc, PhD), Department of Animal Science and Technology, Federal University of Technology, P. M. B. 1526 Owerri, Imo State, Nigeria.

Research literarily means investigation undertaken to discover new facts and findings to get additional information that could help solve a nagging problem that affects greater number of people, livestock, crops, environments, societies, states, countries or even the world. A researcher should have the ability of constant thinking and qualitative reasoning especially when there is an on-going research work. Through constant thinking, reading of literature, studying and reviewing the work at hand, new ideas emerge and by so doing, the researcher keeps on improving his/her write up every day. Great countries are built and nations developed technologically, economically, resourcefully and politically as a result of visionary thinking and proper harnessing and implementation of research policies and recommendations. Real good field and laboratory research works should form part of our norms, if Nigeria should move forward and develop to become economically vibrant and technologically self-reliant and be a powerful nation like other giant countries of the world. This text contains Guides I, II, III and IV divided into chapters one, two, three and four respectively which provides enough logics and secrets employed in scientific and technical writing. It is therefore, recommended to all students, researchers, staff of colleges, schools, polytechnics and universities in Nigeria and elsewhere in the world.

Preface

This Book, Project and Journal Article Writing for Agricultural Science and Related Disciplines, is a guide. It is a product of positive, visionary and innovative thinking conceived and nurtured over the years out of observing lots of confusion, difficulties and frustrations confronting ever anxious, desperate young graduating students and researchers. This led to its designing and compilation to help and guide final year students, researchers and all stakeholders in the field of agricultural science and other related disciplines. Graduating students may embark on self-reliant research project work from start to its logical conclusion without much problem using this guide. It critically identifies and treats the most important and demanding basics, fundamental ground rules, and essential items required for any meaningful scientific research work. Research and journal article writing is one of the pre-requisites to attain the peak of the profession in an academic community. When you fail to publish you perish and lots of beneficial ideals and knowledge perish with you.

To students, it's poignant to point out that they should learn to conduct and write a fairly good research project and graduate with flying colours or ignore the tactics, rudiments, nitty-gritty and be frustrated within the academic environment. It is the author's sincere desire; hope and faithful prayer that, whoever reads this book with great zeal and comprehension, will find it up to date, promising and fulfilling to answer the many research questions that they were unable to answer before.

Contents

Chapter 1: Guide I

1.1 Title of a Project/Journal Article

The title of any project or journal article tells the reader what the study is all about. The title may not necessarily be a complete sentence but could be a phrase that is concise, accurate and informative. The aim is to give the reader as much information as possible using few words. It should contain key words of the project or journal article, minimizing words and space for the benefit of information retrieval systems. A good title for a research report describes the contents of the project or journal article accurately, describes the subject as specifically as possible, avoids abbreviations, formulas and jargon, usually omits the verb and is only a label. It should be catchy, interesting and precise. A title should contain no more than 10 - 18 words for undergraduate work and journal article. But, it could contain more than 18 words for a Master's Degree and PhD work. The most important phrases should come first. It should appear on the cover/front page of the project work/journal article.

The title of a project or journal article will probably be the most read than any other part, both by researchers scanning through the contents of a project or journal article and by those depending on searches through secondary sources, which always carry the title and author's name. The title may be reprinted in bibliographies and subject indexes, stored in bibliographic databases and cited in other projects and journal articles. A good captivating title may help future researchers to find important information while a poor boring title hampers them from doing so.

1.2 Criteria for Choosing a Good Project/Journal Article-Title

Each title that is proposed for research has to be judged according to the following criteria.

1.2.1 Relevance

Normally, the title a researcher chooses should reflect a priority problem. This problem may be identified by the researcher and his research team working in an area, together with livestock or crop farmers from that community. Questions to be considered should include:

- What is the nature of the problem?

- What is the magnitude of the problem?
- And is the problem worth researching?
- Who are affected by this problem?
- How severe is the problem?

A researcher should think of serious agricultural problems that affect large number of farmers, or of the most serious problems that are faced by managers of agricultural systems in the locality where he/she resides or in the locality where he/she intends to conduct the research.

1.2.2 Avoidance of Duplication

Before a researcher decides to carry out a study or research, it is important that he/she finds out whether a previous research on the suggested title has been undertaken within the proposed study area or another area with similar conditions. He/she does that by literature review and going through other peoples work. If the title has been researched before, the results should be reviewed in order to explore whether major questions that deserve further investigation have remained unanswered. Otherwise another title should be chosen.

1.2.3 Feasibility

A researcher should look at the project he/she is proposing and consider the resources required to conduct the research. Thought should first be given to manpower, time, equipment and funds that are locally available at his/her disposal. In situations where the local resources necessary to carry out the project are not sufficient, he/she might consider seeking resources available at the national level; for example, in research units, research councils, colleges, Institutes, polytechnics or universities. Finally, he/she should explore the possibility of obtaining technical and financial assistance from outside sources, that is, from the international community.

1.2.4 Political Acceptability

In general, a researcher is advised to consider a topic which has the interest and support of the governments at local, state or federal levels. This will enhances the chance that the results of the study will be implemented. However, under certain circumstances a researcher may feel that a study is required to show that a government policy needs adjustment. In order to limit the chances of confrontation, one should in that case, make extra effort to involve the policy

makers concerned at an early stage.

1.2.5 Applicability

It is most likely that the recommendations from the study will be applied. This will not only depend on the blessing of the government but also on the availability of resources required for implementing the recommendations. The opinion of the potential clients and that of staff directly concerned with the problem will influence the implementation of the recommendations as well.

1.2.6 Cost-Effectiveness

The basic question here is: Are the resources of time, manpower and finances the researcher will be investing worthwhile given the findings? To answer this question the researcher needs to also know; what difference or change will the results of the study make to the existing programmes?

1.2.7 Timeliness

Here the researcher must of necessity consider this question: Will the findings of the study be available in time to enable the making of necessary decisions? A researcher needs to be clear on how urgent the results are required in order to make decision on which research should be conducted first and what can be carried out later.

1.2.8 Ethical Considerations

The question being considered here is: How acceptable will the research be to those who will be studied? (It is paramount that cultural and religious sensitivity of the study area be given careful and serious consideration). Imagine mounting a research work that pertains pig breeding and alcohol production in some states and areas where religion abhors and seriously frowns at eating of pork and alcohol consumption. Can informed consent be ensured to carry out the study? Has the condition of the subjects been taken into account? Have ethics on experimental animals been fulfilled? For example, if individuals or their crops/ animals are identified during the study as requiring treatment, will this treatment be given or accepted? What if such treatment interferes with the researcher's study results?

1.2.9 Environmental Considerations

Under this sub-heading, the following questions have to be answered correctly: Is the setting of the research experiment going to constitute an

environmental challenge to both humans and animals? Is it environmentally friendly? Is the research work going to reduce agricultural land and create a lot of canals that will eventually cause gullies and erosion? Consider conducting a research that involves nuclear energy in agricultural technology that is dangerous to human and animal lives. These factors also matter a lot.

1.3 Examples of Well Framed Project Titles

1) The Use of Donkeys, Camels and Oxen for Post Emergence Weeding of Farm Lands in North – Eastern Nigeria.
2) Comparative Evaluation of Animal and Plant Protein Intake in Northern Adamawa State, Nigeria.
3) Analysis of Water Supply Characteristics for Domestic and Agricultural Uses in Lala District, Gombi Local Government Area, Adamawa State, Nigeria.
4) Impact of Abattoir Waste on Aquatic Life: A Case Study of Yola Abattoir.
5) Evaluation of Fertility Rate in Friesian and White Fulani Breeds of Cattle Following Artificial Insemination.
6) Replacement Value of Yellow Sorghum *(Sorgum bicola)* Variety for Maize in Broiler Diets.
7) Highlights on the Use of Donkeys for Land Cultivation in Adamawa State, Nigeria.
8) Incidence of Repeat Breeding Syndrome in Cattle from Four Local Government Areas of Adamawa State, Nigeria.
9) Performance and Nutrient Digestibility of Rabbits Fed Urea Treated Cowpea Husk.
10) Characteristics of Reproductive Tracts of Repeat Breeders in Cattle.
11) Seasonal Performance and Feeding Characteristics of Sokoto Red Goats.
12) Foetal Wastage in Ruminants and Sustainable Livestock Industry in Nigeria.
13) Physico-chemical Characteristics of Water Available for Livestock and Human Use in Lala District, Gombi Local Government Area, Adamawa State, Nigeria.
14) Effect of Feeding Graded Levels of Decorticated and Un- Decorticated Neem (*Azadirachta indica*) Seed Meal on Laying Japanese Quail (*Coturnix coturnix japanica).*
15) Efficacy of Aduwa (*Balanites aegyptica*) Seed Cake on Gastro Intestinal

Worm Burden in Growing Chicken.

16) Seasonal Abattoir Foetal Wastage, Food Security and the National Economy.
17) Growth Performance of Japanese Quail (*Coturnix coturnix japanica)* Fed Graded Levels of Decorticated and Un- Decorticated Neem (*Azadirachta indica*) Seed Meal.
18) Trailing and Preservation of Local Breeds of Livestock for Sustainable Agriculture in Nigeria.
19) Comparative Evaluation of Live Weight with Market Prices of Rams in Mubi, Adamawa State, Nigeria.
20) Aspects of the Hematology and Serum Biochemistry of Sahel and Sokoto Red Bucks at Mubi, Adamawa State, Nigeria.
21) Effects of Nitrogenous Feed Supplements Utilization on the Performance of Red Sokoto Bucks Grazing Natural Vegetation in Bauchi, North-Eastern Nigeria.
22) Testicular Sperm Reserve of Sokoto Red and Sahel Bucks from Mubi Main Slaughter House, Adamawa State, Nigeria.
23) Role of Information and Communication Technology in Nigerian Livestock Industry.
24) Foetal Wastage in Goats and the Associated Economic Implications.

1.4 Preliminary Pages of a Final Year Student Project

After the successful choice of a project title, the write up should usually follow this pattern which is most often used in institutions of higher learning that run agricultural science based courses in Nigeria. The courses, ANS 599 or AGR 599 (Final year project for undergraduate students), AS 608 or PP 606 (Final year project for master's students) and AS 799 or PP 708 (Final year project for PhD students), are usually a four-unit and compulsory course in almost all the Universities of Nigeria. It is designed to expose all final year students to the basic tenets of research and project writing. It equally offers students the opportunity to handle equipment in relation to animals and crops and to appreciate day-to-day problems associated with agriculture.

Undergraduate final year project is just like an introduction to project and research or technical writing. Students may not necessarily be required to do much elaborate investigation. It may have few objectives, hypotheses and experiments. The scope may be short in length, questionnaires and simple

descriptive statistics are allowed as tools for research. Group project or joint authorship is also allowed to reduce expenses, encourage the lazy or weak ones and authenticate the work since two heads are better than one. It is expected that a research conducted by many researchers could carry more weight because of the different minds discussing the issue and ideas coming from individual contributions. All the researchers may not want to lie about their findings as compared to a single author that may seat down in one corner and cook up data which may not be reliable. The disadvantage of joint authorship is that, some unserious students may rely completely on the serious ones and may not participate fully and contribute technically in the research.

Master's and PhD work, otherwise known as thesis and dissertation, is a graduate students' research that may require thorough and in-depth investigation of the problem with so many research questions, objectives and at least three experiments to fulfill the requirement for the award of higher degree. The basic characteristic of a thesis or dissertation is its length. A work of this magnitude is the written proof of sustained research conducted over a long period of time, usually 18–36 months. Thesis and dissertation generally contain an extensive review of the literature as well as the results of several experiments which are aimed at testing a single hypothesis. Sample size should be large enough to give a good representative of the sample area. The entire thesis and dissertation work should range from 100 to 400 pages with 50 to 200 references and with up to 10 or more tables, figures and graphs. The postgraduate students are expected to master their work by studying it very well. Usually, it is an individual thing since they are assumed to have had experience in project or technical writing. They may require research assistants for extensive and adequate data collection. More advanced statistical tools are used in the analysis of the results in postgraduate programmes than undergraduate work for good and accurate precisions.

Projects embarked upon may be nutritional or field experiments, breeding, management, surveys etc. The entire work is grouped into five or six chapters apart from the title page and abstract. At the end of the second semester in 500, 600, 700 or 800 level, as the case may be, each student is expected to present a seminar paper, participate in oral examinations or defend his/her project, if research is undertaken independently. However, where group or joint project is written and submitted to the department or post graduate school, all the authors will appear before the defense committee to defend their work. But, in every case, bound copies of the work are submitted according to the following sub-headings:

1.4.1 Cover Page/Binding

This refers to the hard cover that binds and packages the entire work together for proper handling and shelving. It also gives room for easy consultation and referencing as a primary source of literature. The colour of the cover page depends on the programme, school or faculty and the institution. In most Nigerian colleges, polytechnics and universities, green is the popular colour normally used by the undergraduate students and purple for post graduate students in faculties of agriculture and agricultural engineering.

1.4.2 Title Page

This is the first page which shows the title of the research or project work. It also carries names and registration number of the student or the researcher, department, school or faculty and the institution. It also shows purpose of the work which fulfills the requirements for the award of the certificate to be obtained and the year in which the research has been conducted and presented. Examples of title page written by different students from different institutions are given below:

a. Organic and Conventional Farming among Livestock Owners in Mubi North Local Government Area of Adamawa State, Nigeria.

By
Abu, Keliya
(SAT/AHP/DAHP/08/02)

Being a Project Submitted to the Department of Animal Health and Production Technology, School of Agricultural Technology, Federal Polytechnic, P. M. B. 35, Mubi, Adamawa State, Nigeria, in Partial Fulfillment of the Requirement for the Award of Diploma Certificate in Animal Health and Production Technology.

December, 2010

b. Comparative Evaluation of Animal with Plant Protein Intake in Mubi North Local Government Area of Adamawa State, Nigeria.

By
Imranatu, Usman (SAT/ND/AHP/07/17),
Adamu, Umar (SAT/ND/AHP/07/20),
James, Tizhe (SAT/ND/AHP/07/14) and
Musa, Saleh (SAT/ND/AHP/07/12)

Being a Project Submitted to the Department of Animal Health and Production Technology, Federal Polytechnic, P. M. B. 35, Mubi, Adamawa State, Nigeria, in Partial Fulfillment of the Requirement for the Award of Diploma Certificate in Animal Health and Production Technology.

December, 2009

c. Incidence of Repeat Breeding Syndrome in Cattle Herds in Four Selected Local Government Areas of Adamawa State, Nigeria.

By
Ibrahim, Hayatu Kubkomawa (B. Tech., F.U.T. Yola)
(M.Tech./AS/06/0191)

A Thesis Submitted to the Postgraduate School, Federal University of Technology, Yola, Adamawa State, in Partial Fulfillment of the Requirement for the Award of the Degree of Master of Technology in Animal Production and Management.
Department of Animal Science and Range Management, School of Agriculture and Agricultural Technology, Federal University of Technology Yola, Adamawa State, Nigeria.

June, 2010

d. Effects of Breed, Year, Season, and Age on Some Reproductive, Fecal Egg Worm Count and Haemato-Biochemical Parameters of Sahel and Sokoto Red Goats in Mubi, Adamawa State, Nigeria.

By
Malachi, Albert Tizhe
(PGS/Ph.D/2005 – 2006/1020225)

A Thesis Submitted to the Postgraduate School, Abubakar Tafawa Balewa University, Bauchi, in Partial Fulfillment of the Requirements for the Award of Doctor of Philosophy in Animal Science, Animal Production Programme, School of Agricultural Technology, Abubakar Tafawa Balewa University, Bauchi, Nigeria.

December, 2006

1.4.3 Declaration

This is a statement made by a student or a researcher indicating genuineness and originality of the work, showing novelty to avoid plagiarism and

duplication of ideas. The statement is signed or endorsed by the student in question. See examples below:

a I hereby declare that, this thesis was composed and written by me and that it is a record of my own research work. It has not been presented before in any previous application for a higher degree. References made to published and consulted literature have been duly acknowledged.

_____ _____

Signature Date

Ibrahim, Hayatu Kubkomawa

(Student)

b. I hereby declare that, this thesis was written by me and it is an original record of my research work. It has not been presented in any previous application for a higher degree. References made to published literature have been duly acknowledged.

_____ _____

Signature Date

Malachi, Albert Tizhe

(Student)

The above declaration is confirmed.

_____ _____

Signature Date

Prof. I. S. R. Butswat.

(Supervisor)

1.4.4 Approval Page/Certification

This is a formal declaration made by a student or a researcher that the research work has been truly read by his supervisor(s) or examiner(s) and found to meet the minimum requirement for the award of the certificate in view. The statement is then endorsed by the student, supervisor(s) or examiner(s) and the head of department. It always appears on the preliminary pages as can be seen below:

a This is to certify that this project work titled: Organic and Conventional Farming among Livestock Owners in Maiha Local Government Area of Adamawa State, Nigeria is an original work carried out by me. It has been read and found to meet the requirement for the award of National Diploma Certificate in Animal Production, in the Department of Animal Health and Production Technology, Federal polytechnic, P. M. B. 35, Mubi. Adamawa State, Nigeria.

Project Supervisor _____

Mr. Kubkomawa, H. I. Signature and Date

Head of Department _____

Dr. Malachi, A. Tizhe Signature and Date

b This Thesis entitled, ”Incidence of Repeat Breeding Syndrome in Herds in Four Selected Local Government Areas of Adamawa State” submitted by Ibrahim, Hayatu Kubkomawa meets the regulations governing the award of Master of Technology of the Federal University of Technology, Yola and has been examined by:

_____ _____

Signature Date

Prof. I. S. R., Butswat

External examiner

_____ _____

Signature Date

Dr. M., Akpan

Internal Supervisor

_____ _____

Signature Date

Dr. Yahaya, M. Sani

Major Supervisor

_____ _____

Signature Date

Prof. Nur, A.

Dean, Postgraduate School

c This Thesis titled, Effects of Breed, Year, Season, and Age on some Reproductive, Fecal Egg, Worm Count and Haemato-biochemical Parameters of Sahel and Sokoto Red Goats in Mubi, Adamawa state, Nigeria by Tizhe, Malachi Albert, meets the regulations governing the award of the degree of Doctor of Philosophy of the Abubakar Tafawa Balewa University, Bauchi, and is approved for its contribution to knowledge and literary presentations.

_____ _____

Signature Date

Prof. I. S. R., Butswat

Major Supervisor

_____ _____

Signature Date

Dr. U. D., Doma

Co-supervisor of committee

_____ _____

Signature Date

Dr. U. D., Doma

Programme Co-coordinator

_____ _____

Signature Date

Prof. D. S., Matawal

Dean, School of Postgraduate Studies

1.4.5 Dedication

This is a written statement made by an author mentioning somebody's name(s) or some people's names or some organizations or some government department, ministry, parastatal, or names of some institution(s), college department etc. at the beginning of his book or thesis to show gratitude and friendship or remembrance of that person(s). Usually, people dedicate their books or theses to their beloved ones like parents, children, spouses and Almighty God as shown in the examples below:

a This Project work is dedicated to Almighty God and my beloved family members.

b This Thesis is dedicated to my family members and the entire Lala Community in Nigeria and the diaspora.

c This Project is dedicated to Almighty God and my parents, Mr. Adiel Elisha and Mrs. Margaret Adiel.

d This Thesis is dedicated to God Almighty, the Merciful and Omnipotent, my Shield, Strength and Strong hold. To Him be the Glory, Forever and ever, Amen.

1.4.6 Acknowledgements

This is an expression of thanks by a writer to people that have contributed immensely towards the success of his research work, book or thesis and life in general. Friends, relations, spouses, teachers, supervisors and mentors or role models are usually acknowledged in the beginning of the write up. In some cases other authors, whose books have been consulted, are as well acknowledged. Sometimes, organizations (international and local), government departments, ministries, parastatals or institutions may also be acknowledged for their materials used. It is also found on the preliminary pages. Examples of acknowledgements made by different successful scholars are given as follows:

a My greatest thanks go to Almighty God for giving me this opportunity, grace, strength, wisdom and understanding for the successful completion of this project work.

I wish to express my appreciation to my project supervisor, Mr. Kubkomawa, H. I., for his open mindedness, support and care during my project writing and others that their names are not mentioned. God bless you all for your support and care for me to become what I am today. My warm appreciation also go to my family members, the likes of Mr. and

Mrs. Keliya, Garba and Thanko, I. Bassina for their maximum support and encouragement that enabled me to complete my studies successfully. I also want to acknowledge all my class mates for their optimum cooperation throughout our stay in the polytechnic. God bless you all, Amen.

b My greatest thanks go to Almighty God. To him is the glory for giving me abundantly the grace, zeal, patience, strength, wisdom and understanding to undergo this advanced graduate programme and also for seeing me to a successful completion of this research work.

I sincerely wish to express my profound gratitude and unreserved appreciation to my supervisors, Prof. A., Kibon and Dr. M. S., Yahaya for their open mindedness, selflessness, constructive criticism and dedication towards the actualization of the research work. My sincere gratitude also go to Dr. Bobbo Goniwa Aminu and other members of academic staff of the department for their all-time encouragement and counseling throughout my stay in the university.

I wish to say a big thank you to my Aunt, Madam Kauna Biyantu Atiko and her husband, Mr. Geoffrey Atiko, Felicia Ibrahim Bachure, E. K. Micah Dingai, Dr. Hassan Mai, Dr. Abdulkadir and the entire Kofare people for their understanding encouragement and support for me to forge ahead and ensure the conclusion of the research work.

c First of all, my greatest appreciation goes to Almighty God for guiding me throughout my school life and through the completion of this write up. I wish to express my profound gratitude to my able supervisor in the person of Mrs. Ogungbe-faji Elizabeth O., for her effort to see that this project has become a success by reading through the entire manuscript. Also my sincere and deep appreciation goes to my father, Mr. Adiel Elisha for shouldering the financial responsibilities throughout my academic pursuit.

I appreciate the contribution of Pastor Hayatu Yusufu, Obida B. Labis, Mr. Dauda Labidi, Usman Ado and Torate. I also appreciate my brothers, sisters and course mates for their contribution both materially and financially which is a pre-requisite to the success of this research and my educational pursuit entirely. I say thanks to them all and God bless.

d I am most grateful to God Almighty for giving me the courage, strength and perseverance and for preserving my life from the beginning to the end

of this study. My sincere and profound gratitude goes to my major supervisor, Prof. I. S. R., Butswat for the rich ideas, constructive criticisms, educative suggestions, fatherly advice and care he rendered to me during the course of this study to see that this study becomes a reality. God that sees and understands human minds and hearts will surely reward him with lots of blessings that man cannot give. I as well thank and appreciate Dr. U. D., Doma, my co-supervisor, for his concern and words of encouragement, especially, when I was critically sick. Sir, you stood by me in times of trials and difficulty, your words were a source of encouragement that strengthened me to carry on with this work.

My profound gratitude also go to Dr. Pam Mancha, who stood by me throughout the period of this study. His constructive guidance and technical advice made this study meet the standards desired. The effort made by Mr. Ezekiel Waba to see that the data for this study was statistically analyzed is highly appreciated. I acknowledge the contributions of my noble lecturers; Prof. S. T., Mbap, Prof. A., Kibon, Prof. Adebitan, Prof. Adegbola and Mr. Demo, K; they have been sources of inspiration to me throughout the period of the study. I am highly indebted to Dr. Addass, A. P and the technologist in charge of Animal Physiology Laboratory, Adamawa State University, Mubi, who helped in sample collection and analyses especially when I was ill. I thank Dr. Mustapha, M. Barau, Rector Federal Polytechnic, Mubi and the entire members of the management for sponsoring this programme. I appreciate the support given to me by the entire members of the Department of Animal Health and Production, Federal Polytechnic, Mubi and friends/relations like Dr Francis Zira, Louis, T. Buggu and Danbiyu, T. I, in a special way, thank my beloved wife, Theresa, My children: Marilyn, Matthew, Matthan, Michael and Martins, my mother Roseline Tizhe, and brothers Cosmas, James and Tumbadakwa for their patience and support. The hurdles are over and the long and late nights in the laboratory which denies you fatherly care in the course of analyzing the samples for this study is a forgone issue. Finally, I remain grateful to my late father, Tizhe-Yantra, for laying a solid foundation for my educational pursuit. Dad, you did not enjoy the fruit of your hard labour, but God that made it so will reward you. And may your gentle soul rest in perfect peace, amen.

1.5 Abstract

In scientific and technical writing, the abstract is usually the summary of your

study. The abstract should clearly summarize the important and salient findings of the study. It should be brief but contain hard facts and actual values. An abstract should state clearly the objectives of the study; describe methodology, important results, mentioning the meaning in terms of significance and possible implications of the work and conclusion. Do not use abbreviations that are only explained in the text. Do not include references in the abstract. Do not refer to the figures, graphs, tables and pictures. Abstract should be written in single line spacing without paragraphs. It should be substantial, informative and adequate, preferably up to 250 words and above, depending on the scope of the work. For example, journal article could carry fewer words in the abstract compared to under graduate project to Master's degree thesis and PhD dissertation, respectively. It is expected that, undergraduate project should carry fewer objectives than post graduate work, which many at times will require three or more experiments to fulfill the requirements for the award of higher degrees. Abstract is written on the preliminary pages. Examples of good abstracts are:

a. The study investigated the incidence of repeat breeding syndrome in cattle and determined the progesterone profile of repeat breeders in four Local Government Areas of Adamawa State, Nigeria. Data were obtained from individually identified repeat breeders on herd basis by the aid of herdsmen and the use of farm records where available. One hundred herds were visited during the study, made up of 25 from each Local Government Area. One hundred and seventy one (171) blood samples were collected from 57 identified repeat breeders. From each repeat breeder, 5 ml of blood was collected through the jugular vein using a 10 ml syringe. This was done three times on weekly basis to cover the length of the estrus cycle. Thereafter, serum was separated into plain vials by centrifugation and stored at $4^{O}C$ prior to determination of progesterone levels. Serum progesterone concentration was estimated using Enzyme-Linked Immunosobant Assay (ELISA) technique. Data generated were subjected to descriptive statistics and analysis of variance (ANOVA) to estimate the level of significance and the proportion of repeat breeder syndrome in the study area. One hundred herds were sampled during the study and fifty-seven repeat breeders were identified. The proportions of repeat breeding syndrome within the four Local Government Areas were given as 1.59, 1.28, 1.49, and 1.71% for Girei, Yola North, Yola South, and Fufore respectively. The overall incidence was 6.08%. Seven of the repeat breeders were pregnant, ten cyclic and forty non– cyclic. There was no significant variation in the progesterone profile of the non-cyclic repeat breeders during weeks 1 and 2 ($p>0.05$) and 2 and 3 ($p>0.05$). However, there was significant variation during weeks 1 and 3 ($p<0.05$). The

progesterone concentration of the pregnant repeat breeders was not significantly varied during weeks 1 and 2 ($p>0.05$), varied significantly within the weeks 1 and 3, at 51.5 ± 0.8944 and 50.2 ± 0.089ng/l ($p<0.01$) respectively and 2 and 3 ($p<0.014$). The progesterone levels of the cyclic animals were extremely varied within weeks 1 and 2 ($p<0.001$); 1 and 3 ($p<0.001$) and 2 and 3 ($p<0.001$). Repeat breeding syndrome is a multi-factorial condition, which has become a major source of economic waste in the cattle industry due to the need for more inseminations or services, increased calving interval, reduced milk production and increased culling rates.

b. The study was conducted to describe the socio-economic characteristics of livestock producers, determine sources, type of information and communication technology obtained, assess level of utilization and effect of information and communication technology on the Nigerian livestock industry. Data were obtained through random administration of 1000 questionnaires to livestock producers and oral interview of herdsmen. Results showed that seventy percent (70%) of the livestock producers contacted were men, 45% were between the ages of 31 and 49 years old, 65% of the livestock producers are married with 30, 20 and 10% having OND/NCE, Nomadic education and degree qualifications, respectively. Also, 50, 40 and 10% of livestock owners are Moslems, Christians and traditional believers, respectively. While, 60% are fulltime farmers, 35 and 5% are absentee farmers (civil servants) and students, respectively. Farmers are more familiar with radio (50%), mobile phones (20%) and television (15%) than internet (5%), magazines(5%) and newspapers (5%). About 30% of the livestock producers use ICT to watch football and other sporting activities, 20% to obtain agricultural information and 20% use ICT for political news, whereas 5% use ICT to obtain health information and 5% as business outlet, 10% also use ICT for entertainment and 10% for religious news. Only 30% of the farmers agreed that ICT have positively impacted on their livestock agriculture while 70% confirmed that they have not been able to coordinate and harness information obtained from ICT to improve their productivity in livestock agriculture. This showed that there is still limited level of awareness on the use of ICT to improve and enhance livestock production in Gombi Local Government Area of Adamawa state, Nigeria.

c. The study was carried out to evaluate the characteristics of water supply for domestic and livestock uses in Lala District of Gombi Local Government Area (LGA), Adamawa State, Nigeria. Questionnaires, oral interviews and visual observations were used to generate data on sources of water supply, distance traveled to collect water, time spent fetching

water and different water uses. It was revealed that, most of the inhabitants depend on hand pump boreholes (37.0%), water vendors (25.5%), hand-dug wells (15%), streams (13%) and public overhead tanks (9.5%). Thirty four percent of the respondents traveled less than 1000 m, 33% traveled 500 m, while another 12.5% traveled more than 200 m to collect water. Only 20% traveled about 100 m to collect water from their hand-dug wells, boreholes and taps. Forty five percent of inhabitants fetch water at no specific time, 34.5% in the mornings, 11% in the afternoons and 9.5% in the evenings. Seasonal variations in the water table within the study area, leads marked shortage of portable water, especially during the dry season. The findings indicated that water was used essentially for human consumption, laundry, cooking, and for livestock. Water supply in the area was, however, insufficient and irregular for both human and livestock uses.

d. The study was conducted to evaluate testicular sperm reserve of red Sokoto and Sahel bucks in relation to effects of year, season, breed, age, live weight and body condition score. A total of 32 bucks of 12 months old comprising 16 from each breed were obtained from small scale subsistence farmers at Mubi livestock market. These animals were raised across four seasons, early dry and late dry, early wet and late wet for the period of two years. Animals were aged by dentition method, weight determined by clinical weighing scale and body condition scores determined using Scale six grades 0–5. Scrotal circumference was determined in cm using a flexible metric tape before the animals were slaughtered. Testicular measurements were carried out post-mortem and the testes preserved in an ice box before being taken to the laboratory. The gonadal and epididymal sperm reserve were determined. The results revealed that, there were no significant differences ($p>0.05$) among variables RTSR, LTSR and PTSR for the years 2008 and 2009. But significant ($p<0.001$) seasonal effect was observed, with early dry season having the highest values followed by late wet season and early wet season having the least values among the variables. Least sperm reserve values for right, left and paired testes were observed during the early wet season. Also, a significant ($p<0.001$) breed difference was observed with respect to testes sperm reserves, with largest volume in Sahel bucks, while the values in Sokoto Red were lower. Age group variability significantly ($p<0.001$) influenced sperm production ability of bucks. The age group ≥ 3 years recorded the highest sperm reserves. Correlation matrix showed significant ($p<0.001$) positive correlation ($r=0.58$, 0.75, 0.69, 0.77, 0.76, 0.67, 0.77, and 0.78,) between live weight, BCS, SC, WLTLG, WLTVL, WLTWT, WRTLG, WRTVL, and WRTWT. Very highly significant

($p<0.001$) negative correlations (r-values) were observed between age, season and humidity and all testicular parameters measured. Testicular variables and testicular sperm reserves showed very highly significant ($p<0.001$) correlation (r-values) between live weight and all other variables, and highly significant ($p<0.001$) negative correlation (r-values) between age, humidity and the rest of the variables. It is concluded that, goats are very conscious of seasonal variation in the quality, availability of crop residues and liberty to select, scavenge with aversion to high humidity. These affect their general performance in life. Livestock producers are advised to take note of these findings to enable them plan adequately in order to achieve their targets.

e. The objective of this review is to highlight the technologies used for determination of feed intake and digestibility in ruminant animals. N-alkanes, saturated, aliphatic hydrocarbons with length varying from 21 to 37 carbon atoms are used successfully by many researchers to determine feed intake and digestibility in ruminant animals. N-alkanes are parts of the cuticular wax of plant leaves and usually are ether extract which are indigestible in nature. The oral administration of n-alkanes has been used in digestibility trials with domestic and wild ruminants as well as monogastric animals to measure feed digestibility and feed intake of the available herbage. N-alkanes can be supplied to animals in different forms. Some studies have used Pelleted feed made of paper strip embedded with synthetic n-alkanes as external markers to estimate feed intake of sheep. Similarly, sheep were fed with n-alkanes (C_{28} and C_{32}) in the form of gelatin capsules of powder cellulose, previously added with a known amount of n-alkane dissolved with n-hexane or n-heptane, to estimate forage intake. Some researchers have developed a different method that consisted of mixing n-alkanes with solvents and powder cellulose, resulting in a homogenous suspension that, after being evaporated and dried, was inserted into gelatin capsules. Another technique in which particles of *Pennisetum clandestinum* were mixed with n-alkanes suspended in a xanthan gum (0.4%) and infused into the rumen of sheep using either dose guns or disposable syringes. Some studies reported that between-species differences in n-alkane profiles could also be used to determine the proportion of each plant species in the diet. In the same vein, indigestible internal plant markers such as lignin and acid detergent fibres are also used to determine digestibility in ruminants. Grazing time alone cannot be used to determine dry matter intake of grazing animals because intake rate also must be considered. To evaluate the preferred diet intake of grazing animals, it is necessary to spatially separate the forages being evaluated to eliminate the constraints that occur within an intimately

mixed sward. Because plant species or parts can differ markedly in nutritive value, the botanical composition of consumed herbage can have a profound effect on the provision of nutrients to the animal. In an agricultural context, this is especially relevant for grass/legume mixtures, because the consumption of legume will usually result in better animal performance. For rangeland cattle, the higher consumption of some plant species rather than others not only has nutritional effects on the animal but can also have an important influence on the species composition of the plant biomass, with consequences for ecological sustainability.

f. The study was carried out to investigate the feeding management of pastoralist cattle and conflict resolution strategy of Fulani pastoralists in tropical humid rain forest zone of Imo state, Nigeria. Data was generated with the aid of questionnaires, personal interview, field measurement and observations. Frequency tables were used to give a presentation of the information obtained. The results showed that, 77.3% of pastoralists' cattle holdings are White Fulani (Bunaji), produced for breeding and dual purposes. The results revealed that, 100% of pastoralists allow calves between the ages of 0-8 weeks to suckle their dams for six to nine months for colostrum and fast growth. The results revealed as well that, there are no special feed offered to the cattle during breeding seasons. The animals virtually depend on the natural available pastures for nutrient requirements. But 100% of the pastoralists offer salt lick to their cattle to supplement for minerals obtained from forages. The results revealed that, 100% of Fulani pastoralists take their herds to the streams and rivers sides to drink water and not dams, reservoirs, bored holes, wells or tap water. The diversity and ever green forages and fodder make it possible for year round feed supply to the cattle. The results revealed that, 81.8% of pastoralists have had conflicts with indigenous crop farmers because of animals destroying crops during herding in the study area. However, conflicts with crop farmers threaten pastoral access to shared material resources, thus, impacting negatively on the sustainability of pastoralism in the forest zones. The results had it that, 13.60% of pastoralists have had cases of animal theft, while 4.60% claimed not to experience any case of animal theft. It was concluded that, conflict resolution strategies were through village heads, town authorities and the Army. In Nigeria, the clashes between the Fulani and crop farmers have intensified as desertification, deforestation, and climate changes continue unchecked by successive governments. It is recommended that adequate information be given to Fulani pastoralists on better and improved feeding methods. The cattle rears and crop producers are important contributors to the economy

of the region. There is a need to provide grazing routes to solve the issue of conflicts that always result to blood bath in Nigeria.

1.6 Table of Contents

This is the list of items that appear in the text in a summary way indicating the pages for each item for easy referral and proper citations by all readers who may want to consult the write up. It gives the reader an easy summary of the book at a glance and grasps attention of the reader to make the book a must-read. This also appears on the preliminary pages of the researcher's write-up.

1.6.1 List of Tables

All the tables used to present results and findings of a research work are summarized under this sub- heading.

1.6.2 List of Figures/Abbreviations

This gives a summary of all pictures or photographs, graphs, bar charts, histograms, pie charts or any short form of writing long words that were used to explain the result. The titles of figures are given at the bottom of the pictures not on top like in the case of tables. These are usually attached at the back or in some cases in the text as figures 1, 2, 3 and 4 and below a table (abbreviations).

1.6.3 List of Appendices

This is a summary of all analyzed result tables and other data obtained during the research work which has not been used, instead of discarding them, they are sent to the appendices at the last page of the write up for future use.

Chapter 2: Guide II

2.1 Introduction of a Final Year Student Project

The introduction of any project work should answer the questions: Why did the researcher do the work and what did he/she want to find out? The introduction should be short, explicit, preferably not more than two pages for undergraduate and two or more pages for postgraduate programmes. All information put in an introduction must be essential for the understanding of the issue on ground. This part of the work forms chapter one of a project work. Therefore, this should contain four parts:

2.1.1 Background of the Study

This is a brief review of relevant literature and the logical development that led the researcher to do the work. This is to briefly preview any relevant information or facts about the study title prior to this research in order to allow the reader evaluate the present work.

Example of background information of research work titled: *Seasonal Feed Resources Characteristics and Morpho-Physiological Conditions of Cattle Grazing the Guinea Savannah Zone of Nigeria* is given as follows:

Cattle production and breeding in Nigeria is predominantly controlled by pastoralists who constitute a major socio-economic group in the country (Nweze *et al*., 2003; Nori and Davies, 2007; Moutari, 2008). These nomads own more than 93% of the country's estimated 15.3 million cattle population (Umar, 2007; Umar *et al*., 2008; Tibi, and Aphunu, 2010). Pastoralist livestock industry is the country's reservoir of animals for slaughter, milk, animal manure production as well as draft power (RIM, 1992; Parton *et al*., 2007 and Kubkomawa *et al*., 2011). The industry also contributed 19% in 1983 and 1984, 10% in 1998 and 6 % in 2004 and 2005 to agricultural production and 3.2% - 4% to overall GDP of the country (FAO, 1999; CBN, 1999; Mbanasor, 2000; Ifeanyi and Olayode, 2008).

Cattle are produced predominantly in the northern Nigeria where savannah grass pastures are found in abundance. The area, especially the semi-arid zone, is characterized by low rain fall regimes and humidity (Fricke, 1993 and RIM, 1992). The region also has abundance of crop residues and fodder to supplement for the dry season feeding of cattle. There is also prescribed bush burning at certain periods of the year to control parasites and allow for the re-generation of fresh forage for livestock (Fricke, 1993). The pastoralist cattle production system that evolved over the centuries in the zone is based on

grazing animals on natural communal pastures and complementary use of fodder and crop residues (Muhammad and Ardo, 2010; Nweze *et al*., 2012). The system has been defined as an adaptation to the hash and variable physical and environmental conditions of marginal rangelands with a view to harnessing the otherwise un-utilizable biomass for production of livestock (Niamir, 1991). There is, therefore, a transhumance or seasonal cyclic movement of animals and farming families in synchrony to the rain fall regimes that drives biomass availability (Moran, 2006; Okoli and Kalla, 2008). This transhumance is, however, constrained by threats of animal diseases; insecurity, conflict and shortage of forage and water resources for livestock (Muhammad and Ardo, 2010). Transhumance livestock management specifically is becoming increasingly difficult in northern Nigeria due to lack of access to enough land in the wake of rapid population growth and agricultural expansion which result in competitive demand for land resources. The current land use pattern and natural resource development and conservation in Nigeria show that pastoralism is at cross-roads with uncertain future. Livestock development and empowerment of pastoralists is plagued by a number of problems which may include, among many others, diminishing land space for grazing and stock movement; deterioration of existing rangelands with low biomass yields; scarcities of water; poor carrying capacities of available land; concentration of endemic diseases and parasites; low literacy rates and physical isolation of pastoralists; environmental constraints; absence of functional extension services; skewed agricultural development policies as well as an enduring disconnect between government and aspirations of the pastoralists (Okoli and Kalla, 2008; Muhammad and Ardo, 2010).

To the south of this pastoralist zone is the guinea savannah zone that has more abundant rain fall, biomass resources and permanent water sources. However, this and the rest of the rain forest zones further south are notoriously infested with tsetse fly, the vector of trypanosomiasis, and other humidity related diseases and have therefore prevented the sustenance of pastoralist cattle production for ages (Ikede and Taiwo, 1985; Anosike *et al*., 2003). These southern zones are home to major crop production activities in the country. Recent prolonged droughts, resulting in shortage of forage and water resources, more efficient control of tsetse fly down south, the widespread availability of veterinary medicines and the increasing use of cross-bred cattle have led to increased migration of the pastoralists and their animals into the guinea savannah and forest zones of Nigeria. In addition, changes in the political economy of regional livestock markets and ownership have contributed to movements of pastoralists to the south even though they are faced with conflicts of various degrees with indigenous crop producers (Blench, 2010; Nyong,

2010). Thus, the humid tropical rain forest zone of southern Nigeria has become a haven for some pastoralists and their livestock (Okoli *et al*., 2012). However, such conflicts with crop farmers threatens pastoral access to shared material resources, thus, impacting negatively on the sustainability of pastoralism in the forest zones (Tonah, 2006; Ofuoku and Isife, 2009; Okoli *et al*., 2012). Current approaches of preventing these conflicts show that controlling reproduction of animals within the carrying capacity of available land is critical (Okoli *et al*., 2012).

The northern zones, therefore, remain the major environment for cattle production in Nigeria. The breeds of cattle produced in the region are the indigenous Zebu cattle such as white Fulani (Bunaji), Red Bororo (Rahaji), Sokoto gudali (Bokoloji) and Adamawa gudali (RIM, 1992; Umar, 2007; Addass, 2011; Kubkomawa *et al*., 2011). Cattle are highly valued livestock in these northern zones, where it contributes to the local economy and food security. Pastoral production systems play a central role in providing livelihood for rural people, ensuring productive use of marginal lands and contributing to internal trade and earnings (Moutari, 2008). A cattle farming is also a source of employment in the zone (RIM, 1992; Tewe, 1997). Cattle are kept mostly for beef, milk, manure, hide and skins as well as for draught power to plough lands (Tukur and Maigandi, 1999; Kubkomawa *et al*., 2011). They also serve other socio-cultural functions such as payment of bride price, transportation of goods and people, prestige and symbol of economic status (Walker and Salt, 2006; Klein *et al*., 2007).

The feed resources of pastoralist cattle consists mainly of grasses, legumes, browses, and cereal crop residues indigenous to the production zones and have been reported to be of low yield and quality (Shiawoya and Tsado, 2011; Nweze *et al*., 2012). Good quality forage is available in adequate amounts to support reasonable level of cattle production from early to late rainy season (Moutari, 2008). During this period, abundant cattle populations are found in the north (RIM, 1992; Roger, 1999), while at other times, pasture and range plants decline in quantity and quality (Moutari, 2008). During the dry season period, available natural pastures are low in protein, nitrogen, sulphur, vitamins and other nutrients, while fibre is high with dry matter content of more than 30% (Hughes *et al*., 2011). Considerable quantities of crop residues and agro-industrial by-products are also generated every year. However, because of improper management, they are usually lost, wasted or underutilized.

There is a relationship between body condition scores (BCS) of grazing animals and feed availability (Waltner *et al*., 1993). Malnutrition, old age and sickness are major causes of low body condition scores in cattle which affect

every area of production (Drennan and Berry, 2006). Older cattle have less fat over their backs and *Bos indicus* cattle carry more external and internal fat than *Bos taurus*, so also bulls have higher BCS compared to cows (Joe, 2010). A cow's reproductive performance is closely associated with her body energy reserves (Clay *et al*., 2002). For example, a low feeding level at service can reduce reproductive efficiency. Similarly, cows with low body condition scores have reduced fertility rates, milk yield, late postpartum oestrus and low weaning weights (Clay *et al*., 2002).

Body condition scores improve with nutrient availability (DEFRA, 2001) and because of this, it usually serves as a more reliable indicator of nutritional status of animals than body weights (Waltner *et al*., 1993). The general purpose of condition scoring is to achieve a balance between economic and efficient feeding, good management, market weights and welfare (Waltner *et al*., 1993). Addass *et al*. (2010) investigated physiological consequences of season, breed, body condition score and age on epididymal sperm reserve of bulls and showed that reserves were highest during late rainy season in Red Bororo bulls, four years old at BCS 5, which corresponded with the period of feed availability in Mubi, north-eastern guinea savannah zone of Nigeria.

According to Assan (2012), genetic make-up play vital role in reproduction efficiencies, weaning weights and body condition scores in cattle. Higher body condition scores precede higher dressing out percentage with good quality meat which also attracts greater market values. However, production without access to market is a problem for many livestock producers in Nigeria (Usman and Nasil, 2005). Pastoral populations in Northern Nigeria lack reliable marketing outlets that could provide the full benefits of indigenous cattle resources, to be captured by both pastoralists and consumers in the region and beyond. Market prices of cattle in Nigeria are determined by visual evaluation which incorporates elements of BCS, ages, sexes, breeds, live weights and grade (Okoli *et al*., 2005; Adugna, 2006; Tibi and Aphunu, 2010; Mukasa *et al*., 2012).

According to Hughes *et al*. (2011) traditional methods of reducing morphometric effects of lean feed resources period remain forage conservation either as hay or silage during times of abundance to off-set pasture deficit during the dry season. This may serve as a suitable strategy to mitigate the effects of inadequate pasture during the dry season, while supplementing inadequate pasture with tree fodder provides another cost-effective alternative (Adegbola, 1998). However, there is a significant shortfall in supply of the forage, particularly, when required for longer periods. Concentrate supplementation has also been traditionally seen as a reliable strategy; however, cost and availability of local concentrate sources is a major deterrent (Hughes *et*

al., 2011). Use of crop residues and agricultural by-products as intervention nutrients is also commonly practiced (Ibrahim *et al.*, 1983). Movement of animals and splitting of herds have been used by Pastoralists to reduce morphometric effects of lean feed resources period (Ezeomah, 1987; Mathias-Mundy and McCorkle, 1989).

The continual increase in the price of veterinary drugs coupled with their prolonged absences from the state-owned veterinary drug store has continued to sustain the use of ethno- veterinary practices for handling different livestock diseases and parasites (Moreki *et al*., 2012). Such ethno-veterinary practices incorporate medicinal plants, which have been widely used for centuries as a primary source of prevention and control to livestock diseases (Hoareau and DaSilva, 1999). In West Africa, including Nigeria, farmers use traditional methods of curing livestock diseases because they are readily available and at low or no cost at all (McGraw and Eloff, 2008; Chah *et al*., 2009; Okoli *et al*., 2010).

2.1.2 Statement of the Problem

This is the priority problem a researcher has seen facing the society that needs urgent solution. This could be agricultural, humanitarian, managerial or administrative that may need adjustment. This problem must be explicitly and clearly stated as it gives the reader the direction of your research or study. For example, a title of research project like, *Seasonal Feed Resources Characteristics and Morpho-Physiological Conditions of Cattle Grazing the Guinea Savannah Zone of Nigeria*, should have problem statement as: The major challenge to pastoralist's cattle producers in the dry areas of Northern Nigeria is the changing environment, characterized by shrinking land due to expansion in arable farming; land excavations for construction, industrialization and mining activities, which have resulted in shortage of natural forage lands for livestock grazing. The shrinking pastoral land with the opportunities for pastoral people to make a viable living has put the industry in a serious crisis. Political and economic factors are combining to replace pastoral grazing land with other allegedly more beneficial land uses. The eroding feeding resource is also linked to changes in the economy, inappropriate aid, conversion of range lands and mixed farming systems for agriculture and game parks. Diminishing genetic resources is also evident because of product focused selection, changes in knowledge, changes in technology, intensification, lack of storage facilities and conservation and indiscriminate crossbreeding of animals and plants in many tropical environments. The idea that modern or imported breeds are better has led to a loss of knowledge about traditional livestock husbandry and to the erosion of domestic animal diversity. Wars and other forms of socio-political

problems have also led to livestock owners moving their stock out of their usual area, thus, increasing the possibility of mixing with other breeds thereby potentially losing a location-specific breed. In addition, natural disasters such as flood, drought, famine, desertification, global warming, and livestock diseases have in numerous cases resulted to breeds of cattle dying out.

The traditional Pastoralist systems in Nigeria are highly vulnerable because of heightened insecurity situations, while resilience and adaptation options are almost exhausted without any new place to go to because of conflicts with crop producers in the northern guinea savannah and southern rain forest havens. Pastoralism's decline in Nigeria is, thus, a vicious circle: pastoral land use is undervalued, and either ignored or appropriated for alternative uses, thus, making pastoralism less viable and ripe for persistent neglect or appropriation for alternative uses. Decline in the economic viability of pastoral production system has also paved way for the adoption of modern production systems coupled with the intensification of livestock production that rely on veterinary services and improved feeding conditions. Some levels of sedentary system may be the only solution to the current situation. However, the essential components of the traditional system needed to drive this, for instance, the best breeds and feed resources as measured by morpho-physiological scores of the animals across seasons need to be researched. In designing such critical studies, the questions that may need to be asked include:

1. What are the current breeds of cattle in the Pastoralist zones of northern Nigeria?
2. What are the current feed resources available to animals grazing the zones?
3. What are the seasonal effects on cattle in the zone?
4. Which cattle breeds are the most productive in the zone?
5. What are the likely improvement and intensification strategies to be employed?

2.1.3 Statement of Hypothesis

A hypothesis is a prediction or a conjecture about what can be expected to occur under given conditions stated well in advance of observation or collection of actual data. For example, if X1 takes place in a given situation, then Y will be observed. However, if X2 takes place instead, Y will not be observed. To test this prediction, the researcher provides for X1 and X2 to take place or he/she looks for a natural situation where they occur and he/she observes what happens to Y in each case.

There are two hypotheses, which include: Null (H_0) and Alternative (H_1) hypotheses. The Null hypothesis is central in research and is the hypothesis that is tested. It is stated in a negative assertion using words like No or Not. The statistical tests of the Null hypothesis may suggest the rejection of Null hypothesis at a particular level of significance and degree of freedom, as the case may be. The rejection of Null hypothesis (H_0) signals an automatic acceptance of the Alternative hypothesis (H_1). This is because both hypotheses are complementary. Therefore, every Null hypothesis must have an Alternative hypothesis to guide the researcher to look for another way of presenting the relationship between the relevant variables, in case the null hypothesis is not accepted. Example of how to state hypothesis are: H_0: There is no correlation between the productivity of intensively and extensively managed white Fulani breed of cattle in Adamawa State. H_1: There is a correlation between the productivity of intensively and extensively managed white Fulani breed of cattle in Adamawa State.

The two variables in this hypothesis are the management systems and productivity which are given as X and Y respectively. Thus, X variable (the cause), triggers Y variable (the effect) to happen. A hypothesis has several functions in research. These include the fact that:

1. It is a link between the world of reality and that of theory and explanations or abstractions.
2. It transforms the researcher's ideas into testable forms.
3. It helps to specify what variables are to be measured or collected by the researcher in order that he/she may have the expected results or discoveries.
4. It guides the researcher in his research design which helps in the generation of required data.
5. It shows the direction of data analysis.
6. It helps the researcher to organize his research reports.
7. And it helps the researcher to focus his attention and effort in the right direction.

2.1.4 Objectives of the Study

Objective of a project summarizes what is to be achieved by the study. Objectives should be closely related to the statement of the problem. For example, if the research problem is poor utilization of cassava peel diets by broilers, the objective of the study will be to identify reasons for this low

utilization, in order to improve it. If an objective states what is to be accomplished by the study in such general terms, it is called a General Objective. It is possible and advisable to break down general objectives into smaller, logically connected parts. These are normally referred to as Specific Objectives. The general objective to determine factors which influence poor utilization of diets based on cassava peels by broilers could, for example, be broken down into the following specific objectives:

a. Determine the feed intake, feed conversion ratio and weight gain of broilers fed - cassava peel diets in mash form as compared to those given in pelleted form.
b. Determine the feed intake, feed conversion ratio and weight gain of broilers fed low cyanide cassava peel diets as compared to those given high cyanide cassava peel diets.
c. Determine the feed intake, feed conversion ratio and weight gain of broilers fed methionine supplemented cassava peel diets as compared to those fed un -supplemented cassava peel diets.
d. Compare carcass composition of broilers fed the different treatments itemized in a- c above.
e. Make recommendations on how to improve the utilization of diets based on cassava peels by broilers.

The formulation of specific objectives allows a researcher to:

Focus on the study, narrow it down to essentials, prevent a researcher from collecting data which are not strictly necessary to better understand and solve the problem he/she has, organize what he/she hopes to accomplish in the study in clearly defined parts or phases. Also be guided in the development of his/her research methodology and to orient the collection, analysis, interpretation and utilization of data. Cover the different parts of the problem as defined understatement of the problem. To define the problem with precision and make for a better and commendable research report. State his/her objectives using action verbs that are specific enough to be measured. Example of action verbs include: to determine, to compare, to verify, to calculate, to describe, to establish. Avoid the use of vague non-action verbs such as: to appreciate, to understand, to study etc. Define the scope of the study: Under this sub-heading, the researcher explains his/her area of coverage trying to create another vacuum for other researchers to venture into it in later times. It gives the extent to which his/her study objective covers during the research work.

2.1.5 Justification of the Study

Here, the researcher tries to answer questions like: Is the problem at hand really worth researching? What is the severity of the problem? Is the problem noticed somewhere else? How is its effect elsewhere? See example of justification below: a title of research project like *Seasonal Feed Resources Characteristics and Morpho-Physiological Conditions of Cattle Grazing the Guinea Savannah Zone of Nigeria* should have justification as: There is limited literature on the current cattle production characteristics in a changing environment like the guinea savannah zones of Northern Nigeria. The results of the study will add knowledge to science and especially in the area of animal agriculture. Farmers and other beneficiaries such as government, researchers, national, international agencies and non-governmental organizations will find the results useful in planning and decision making on the production purposes, the periods to intensify production and when to market the products for greater profits. The results will help the Federal Government of Nigeria to develop a cattle breeding scheme to provide breeding stock to Nigerian cattle farmers. Policy makers and all stake holders will also use the data to make policies that would provide intervention strategies to lean feed resources such as fodder banking, genetic modification of the cattle, parasitic control which will help to boost and sustain animal agriculture. The results will also aid government in the settlement of Pastoralists in Nigeria through societal awareness of the detrimental effects of this extensive livestock system. Therefore, the improvement of this pastoral system without the loss of their traditional values (re-evaluation of little-productive land, environmental conservation) requires a good knowledge of their production characteristics, their strengths, weaknesses at the herd level and within the frame work of the overall farming sector.

2.2 Literature Review

The literature review is a summary of the critical evaluation of previously completed work which, in the author's opinion, is relevant to the present study. It stands for the relationship of his/her study to other related prior investigations. In a research paper or journal article, the literature review is usually found between the problem statement and the description of the procedures. Its function is to look again (re + view) at the literature (i.e. the reports of what others have done) in a related area: an area not necessarily identical with but collateral and similar to your own area of study.

A review of the literature will show what other researchers have done, reveal studies relevant to the present one, reveal sources of data unknown but exist,

provide new ideas and approaches to the solution of the problem and finally place the present study in historical and associated perspectives in relation to earlier studies relevant to the problem.

Emphasis should be placed on areas of agreement between the results and the literature review to strengthen the credibility of the study. This is normally written in chapter two of a project work. Literature search and strategies for looking for specialized articles (the importance of key words for example) is paramount. Some of the modern methods used in literature search are the internet facilities such Google search engine and Wikipedia. Catalogue of books in the library can also help in literature search. Normally agricultural students are not used to the basics of taxonomy. This is something important, as most of the information generated in the biological sciences is directly linked to a species name. If a species name changes, as it normally happens in some areas (e.g. parasitology), the existing information on that species may be linked to another species name, different from the valid name in use. The literature can be categorized into 3 main classes, namely: primary, secondary and tertiary literature.

2.2.1 The Primary Literature

The original reports of prior scientific and technical investigations make up the bulk of the primary literature. Most of them are accounts of experiments undertaken with findings and conclusions. They include periodicals, research reports, conference proceedings, patents, standards, theses, dissertations, encyclopedias, unpublished works, short communication and verbal discussions. The primary literature helps a great deal on how to more properly organize the research work as it broadens the knowledge of the researcher on the study subject. The primary literature is mostly widely scattered, disconnected and unorganized. Though of vital importance, they are always difficult to locate and to apply. Therefore, to obtain relevant primary literature is itself the first bulk work of the researcher.

2.2.2 The Secondary Literature

The secondary literature is compiled from the primary sources and is arranged according to some definite plan. They represent a worked-over knowledge rather than new knowledge. They organize the primary literature in more convenient form. By their nature, they are often more widely available than the primary sources and in many cases, more self- sufficient. They are mostly indexing and abstracting services, reviews of progress, reference books, treaties, monographs or text- books. They repackage the information from the

primary literature and guide the researcher to the original document. They serve not only as repositories of digested facts but as bibliographical keys to the sources.

2.2.3 The Tertiary Literature

The tertiary literature does not carry subject knowledge at all. Their main function is to assist the researcher in using the primary and secondary sources. Tertiary literature include guides to the literature, list of research in progress, guides to organizations, lists of indexes and abstracting services, directories, yearbooks and bibliographies. Obtaining good and relevant tertiary literature leads the researcher to ways and means of obtaining the primary literature more easily. A review is like an essay and, therefore, must be organized, logically arranged and readable. The review should be presented in a simple and clear language; repetitions should be avoided.

Previous findings (both positive and negative) in the field should be highlighted, authors properly cited and areas of further research stressed. It is important to emphasize that, review should cover pertinent and relevant works of others only; authors that agree and those that do not on the subject matter should, if convenient, be grouped. A reviewer should use his own language and not transcribe someone else's language. Note that, a review entails a critical appraisal of articles, papers or subject matter not mere summaries. Information for your review may be obtained from journals; magazines; newspapers; textbooks; theses; monographs; bulletins and the internet. Always try to highlight the most current information on the subject matter. It is also good to search for very good old papers, that brought unedited ideas/concepts/results and which deserve citation, depending on the case.

2.3 Materials and Methods

Under materials and methods, as the name implies, the researcher tries to list and describe all the materials that were used during the research work from start to conclusion. He/she also describes the methodology employed in carrying out the project work. It is found in chapter three of the project work. It has the following sub-headings:

2.3.1 Description of the Study Area

This section starts with a brief description of the study area, mentioning the location of the area and its geographical characteristics, climate (rain fall,

temperature and humidity), type of vegetation, population of humans, livestock and its boundaries and neighboring areas. For example, a livestock study may be conducted in the guinea savannah zone of North Eastern Nigeria, taking Adamawa state as a case study. The researcher then may need to describe the study area as follows:

Adamawa is one of the six states which make up the North East geopolitical zone of Nigeria with Yola as its capital (Adebayo and Tukur, 1997; Adebayo, 1999). It shares an international boundary with the Republic of Cameroon to the east and interstate borders with Borno State to the north, Gombe State to the northwest and Taraba State to the west and south (Adebayo and Tukur, 1997; Adebayo, 1999). Adamawa State initially existed as part of the Northern Region in the three-region structure of 1954; it was then known as Adamawa Province. In 1967, the military government of General Yakubu Gowon created twelve federal states and Adamawa became part of North-Eastern State (Adebayo and Tukur, 1997; Adebayo, 1999). With the creation of nineteen states in 1976 by the military government of General Murtala Muhammed, Adamawa became part of Gongola State. In 1991, the military government of General Ibrahim Babangida divided Gongola State into Adamawa and Taraba states.

Adamawa State occupies an area of 38,823.3 square kilometers. It lies at latitude 9°20' North and longitude 12°30' East. It has minimum and maximum rainfall of 750 and 1050mm and an average minimum and maximum temperatures of 15^0c and 32^0c. The relative humidity ranges between 20% and 30%. The major vegetation is northern Guinea savannah (Adebayo and Tukur, 1997). The valleys of the Cameroon, Mandara and Adamawa mountains form part of its landscape. It has a population of 3,178,950, representing 2.3 percent of the Nigerian total population, and a population density of 82 people per square kilometer (Adebayo and Tukur, 1997; Adebayo, 1999). The Fulani are the original inhabitants of Adamawa State. The state derives its name from Modibbo Adama, a disciple of Usman Dan Fodio and the founder of the Adamawa Emirate. The emirate, which traces its origins back to 1809, is headquartered at Yola. The emirs are known by the traditional title of Baban-Lamido.

The main ethnic groups in the state are the Fulani, Quadoquado, Lala, Bwatiye, Chamba, Higgi, Mbula, Margi, Kilba, Ga'anda, Longuda, Kanakuru, Bille, Bura, Yandang, Yungur, Fali, Gude, Verre and Libo (Adebayo and Tukur, 1997; Adebayo, 1999). The dominant religions in Adamawa State are Islam and Christianity, although some of its inhabitants still practice traditional religions.

There are twenty-one Local Government Areas (LGAs) in the state as shown

in the map. The major occupation of Adamawa people is farming. Cash crops grown in the state include cotton and groundnuts, cowpea, benni seed, bambara groundnut, tiger nut, while food crops include maize, yam, cassava, guinea corn, millet and rice. The village communities living on the banks of rivers engage in fishing while the Fulani and other tribes who are not resident close to rivers rear livestock such as cattle, sheep, goats, donkeys, camels, horses and poultry (Adebayo and Tukur, 1997; Adebayo, 1999). The mineral resources found in the state include iron, lead, zinc and limestone.

Tertiary educational institutions in the state include: Modibbo Adama University of Technology, Yola, (former FUT Yola) and American University of Nigeria, Yola, Adamawa State University, Mubi, Federal Polytechnic, Mubi, and Federal College of Education, Yola. The state also has Adamawa State Polytechnic, Yola, School of Nursing and Midwifery, Yola, College of Education, Hong, College of Health Technology, Mubi, College of Agriculture, Ganye, two Vocational Training Schools and a College for Legal Studies all located in Yola. Tourism attractions in the state are: Kiri Dam, Koma Hills, Mandara Mountains, Shebshi Mountains, Sukur Cultural Landscape, Lamurde Hot Spring, Gashaka-Gumti National Park, Monuments and Museums, Modibbo Adama's Tomb. Annually, Adamawa plays and hosts 32 festivals, including the three-day Zhita in Bazza as well as Dukwa and Yawal in Madagali. There is also Sorro, a Fulani day-long observance commemorating the initiation of a group of young boys into manhood. It is held in Yola and usually takes place in February. The Kilba people of Hong are renowned for their Tiwe festival which runs for 120 days. It is a funerary rite which features sacrifices to ancestors, the pouring of libations, incantations and drumming, singing and dancing, as well as street processions. Festivals such as the Njuwa Fishing Festival, which holds at Lake Njuwa in Yola, the Yinagu Fishing Festival at Michika and the Farai wrestling festival in Demsa attract people from within and outside the state from the month of March through to May each year (Adebayo and Tukur, 1997; Adebayo, 1999).

2.3.2 Experimental Design

The choice of treatments, the method of assigning treatments to experimental units and arrangement of experimental units in various patterns to suit the requirement of particular problems and area, is known as the design of experiment or experimental design. The purpose of designing an experiment is to increase the precision of the experiment to reduce experimental error. Designing an experiment is a very important step to take because errors made in the design can invalidate the result of the entire study. It is wise to avoid complex experiments. Success normally comes when simple designs are used.

The most abled Statistician cannot help any researcher to reach and draw valid inference from a poorly designed experiment.

2.3.3 Steps to Follow in Conducting an Experiment

1) Always design an experiment paying close attention to the variability of the materials you intend to work with.
2) Apply the contrasting treatments and carry on with the experiment.
3) Make the necessary measurements or counts, such as yields, weights in grams etc.
4) Reduce the data to simple terms by calculating the means, standard deviation (SEM).
5) Make a Null hypothesis.
6) By deductive reasoning method, determine the probability to see if the differences observed would have been greater than those obtained if the Null hypothesis were true, that is P = 0.05, P = 0.01 or P = 0.001.
7) Decide whether to reject or accept the Null hypothesis. It is considered rejected and the observed differences considered significant, if the probability in (f) above is less to the previously decided number at 0.05 level.

2.3.4 Techniques of Experimental Design

To reduce error, a researcher adopts certain techniques which form the basic principles of experimental design. The basic techniques include: replication, randomization and local control.

(1) Replication

Replication means that a treatment is repeated two or more times. Its function is to provide an estimate of experimental error and provide a more precise measure of treatment effects. The number of replications that will be required in a particular experiment depends upon the magnitude of difference you wish to detect and the variability of the data you are working with. Considering these two things at the beginning of an experiment will save much frustration. An experiment with a single replication will give a poor measure of treatment effect.

(2) Randomization

Randomization is the assigning of treatments to experimental units so that all units considered have equal chance of receiving a treatment. It functions to assure unbiased estimates of treatment means and experimental error. The

researcher normally talks about chances and variation due to many factors that are unknown and beyond his control. Such factors may range from: Light intensity, genetic constitution, soil heterogeneity, temperature variation, disease infections, measurement errors, noise etc. that may affect the outcome of the experimental units. Such factors may change with time, location of the experimental field, liter size, and green house bench, location of animal pen or cage and weather conditions as influenced by season. A typical example of some extremes in randomization that can be misleading is feeding group of white Fulani breed of cattle with one type of ration (A) and Red Sokoto with another type of ration (B) in an attempt to measure daily weight gain using the two diets A and B.

(3) Local Control

This principle of experimental design allows for certain restrictions on randomization to reduce experimental error. For example, in the randomized complete block design, treatments are grouped into blocks that are expected to perform differently, allowing a block effect to be removed from the total variation in the trial.

2.3.5 Types of Experimental Designs

There are many types of experimental designs. These include the following:

1. Single factor experiment e.g. Completely Randomized Design (CRD), Completely Randomized Block Design (CRBD) and Latin Square Design (LSD).
2. Multifactor experiment e.g. factorial, split plot.

Completely Randomized Design is the basic single factor experiment. All other designs like CRBD, LSD are stemmed from it.

(1) Completely Randomized Design (CRD)

When treatments are arranged randomly over the whole of a previously determined set of experimental units, the design is known as Completely Randomized Design (CRD).

CRD is appropriate when the experimental material is homogenous. In field-experiments there are generally large variation among experimental plots due to soil heterogeneity. Hence CRBD is preferred in field experiments. In laboratory experiments and green house studies, it is easy to achieve homogeneity of experimental materials. Therefore, CRD is most useful in such experiments. It

has advantages of being flexible because any number of treatments and replications can be used and it is very easy to analyze even when replication is not the same for all treatments. The only disadvantage is that it is not most accurate due to absence of blocking.

(2) Completely Randomized Block Design (CRBD)

It is probably the most used and useful of the experimental designs. It takes advantage of grouping similar experimental units into blocks or replicates. The blocks of experimental units should be as uniform as possible. The purpose of grouping experimental units is to have the units in a block as uniform as possible so that the observed differences between treatments will be largely due to true differences between treatments. The randomization procedure is that, each replicate is randomized separately· Each treatment has the same probability of being assigned to a given experimental unit within a replicate. Each treatment must appear at least once per replicate.

Suppose the experimental material is divided into r blocks. Let there be t treatments. Each block is then divided into t units and the treatments are allotted within a block at random. The resulting design is called randomized block design or commonly known as Completely Randomized Block Design (CRBD). The advantages of CRBD are that, it measures and removes variability over an experimental area by maximizing differences between blocks and minimizing differences within blocks. It is, also, more precise than CRD due to presence of blocking. No restriction on the number of treatments or replicates. Some treatments may be replicated more times than others. Missing plots are easily estimated. Whole treatments or entire replicates may be deleted from the analysis. If experimental error is heterogeneous, valid comparisons can still be made. The disadvantages are that, blocking cannot remove variability under certain condition such as soil heterogeneity, unpredictable insect infestation and wind direction. Error, df, is smaller than that for the CRD (problem with a small number of treatments). If there is a large variation between experimental units within a block, a large error term may result (this may be due to too many treatments). If there are missing data, a CRBD experiment may be less efficient than a CRD. For example, given four fertilizer rates applied to rice and three replicates of each treatment.

Rep 1	Rep 2	Rep 3	
A	B	A	A=0 kg N/ha
D	A	B	B=50 kg N/ha
C	D	C	C=100 kg N/ha
B	C	D	D=150 kg N/ha

(3) Latin Square Design (LSD)

When the experimental material is divided into rows and columns and the treatments are allotted such that each treatment occurs only once in a row and once in a column, the design is called Latin Square Design (LSD). With Latin Square design a researcher is able to control variation in two directions. Treatments are arranged in rows and columns. Each row contains every treatment. Each column contains every treatment.

In LSD the number of rows and columns are equal. Hence, the arrangement will form a square. E.g. 3 by 3; 4 by 4; 5 by 5; 6 by 6; Latin Square etc. In LSD each row and column are a complete block or replication. Advantages of LSD are that, since treatments are equal by row and column, it is more efficient in controlling variability than CRBD as it can control source of variation by row and column. It can control variation in two directions. It is also a good design because it has some hidden replications. The disadvantages are that, actual number of treatments must be equal to the number of replications. It can't contain large number of treatments beyond 4 to 8. So it is not practicable to use the design when the number of treatments exceeds 4 to 8. The experimental error is likely to increase with the size of the square. Small squares have very few degrees of freedom for experimental error. It can't evaluate interactions between rows and columns, rows and treatments, columns and treatments.

Effect of the Size of the Square on Error Degrees of Freedom is given as:

SOV	Df	2x2	3x3	4x4	5x5	8x8
Rows	r-1	1	2	3	4	7
Columns	r-1	1	2	3	4	7
Treatments	r-1	1	2	3	4	7
Error	(r-1)(r-2)	0	2	6	12	42
Total	r^2 - 1	3	8	15	24	63

Where r = number of rows, columns, and treatments. One way to increase the Error df for small squares is to use more than one square in the experiment.

(4) Factorial Experiment

In this kind of experiment, two or more factors are studied at the same time. For example, if the behavior of a certain variable, say, variety or breed is observed to change with the effect of another variable, say, fertilizer, this behavior can be tested by using factorial design arrangement of treatments. Advantages of this kind of experiment are that, two experiments are performed

in one, interaction between two factors can be tested and there are some hidden replications which increases the level of precision. It broadens the scope of an experiment. It is possible to estimate the experimental effect. It is good for exploratory work where we wish to find the most important factor. Its disadvantages are that, it is complex. The experiment can become very large with the number of factors each at several levels.

(5) Split Plot Design

This is a kind of design used for treatments that are in factorial design or experiment where the precision of one factor is sacrificed for the other. The level of one factor is placed in the main plot, while the other is placed in the sub -plot. The one placed in the sub plot is more precisely measured than the one on the main plot, because soil variability within the sub plot is less than that of the main plot. Split plot design can be: I split plot, II split – split plot, III split – split – split plot.

(6) Covariance Analysis

This is an alternative means of analyzing data when the design used fails to detect or measure certain variability between or within blocks over an experimental area. It has the following uses in agricultural research: To control experimental errors and adjust treatment means, to aid in estimation of missing data and to aid in the interpretation of experimental results. Covariance analysis reduces variability by measuring an additional variable that is covariate X, when the number of insect incidence is linearly related to the primary variable Y. Then the source of variation associated with the covariate is deducted from the experimental error. Once this is done, the primary variable Y can be adjusted up or down.

(7) Incomplete Block Design

In theory, all the designs used in analyzing experimental results can carry any number of treatments. However, it so happens that there exist an inverse relationship between efficiency and the number of treatments. That is to say, as the number of treatments increase, then the efficiency of the design to detect error declines. Hence, with more number of treatments, the experimental error increases.

In order to avoid this, statisticians have devised another means and the device is to use incomplete block design. One of such designs is the Lattice Square Design and the most commonly used Lattice Square Design is the Balance Lattice Square Design (BLSD). The basic characteristic features of BLSD are that, the number of treatments must be a perfect square $t = k^2$, for example, 9, 16,

25, 49, 64, 81 and 100.

The number of replication must be 1 more than the block size, k + 1. For example the number of replication for 25 = 6, 9 =4, 16 = 5, 49 = 8 etc. and the block size k = √t.

2.3.6 Data Collection

Data collection follows questions like: What does the researcher use? What does he/she do and how? If it is a survey work, what method of sampling does the researcher employ? Does he/she use random or purposive sampling? Were questionnaires used? Where and how were socio-economic characteristics of respondents and the medicinal uses of some animal and plant parts obtained? How were the questionnaire drawn and administered? If it is a field experiment, is it a feeding trial? Were samples of feed taken to the laboratory for proximate analysis where ashes, moisture, nitrogen, crude protein, crude fibre, ether extract, dry matter, minerals and fats contents are obtained? Is it a blood or serum sample where hematological and hormonal parameters are measured? Is it a swap or faecal sample where bacteria and other parasites are to be isolated? Is it growing some crops where yield performance and disease resistance or susceptibility is measured? What design methods are employed? And so on and so forth. This is a simple section where a researcher only describes the materials he/she used, and the methods employed during the work. He/she does not need to interpret anything here. However, he/she must make sure he/she has described everything in detail. The important issue is to give enough detail about the methods used to allow other scientists assess the validity and accuracy of his/her results and be able to repeat the experiment to arrive at the same results. If a researcher used well-known methods, he/she should give their names and a reference to support his/her claim but if the researcher made any changes then these should be explained. You should be brief, but do not forget to mention important facts like sizes or volumes, number of treatments, replication, etc.

(1) The Diagnostic Phase in Research in Livestock Systems

To begin an agricultural research program, researchers need adequate knowledge of farmers farming conditions, cultivation and livestock keeping practices, the constraints faced and the development potential that is available. To this end information must be collected and analyzed, potential solutions must be identified, and research priorities must be set. This process of description, analysis and research planning is commonly referred to as diagnostic phase. Description, analysis, and research planning may be grouped

in several ways. Descriptive and diagnostic activities may include both the analysis of collected information and the development by researchers of hypothesis about problem areas and the identification of possible improvements. The diagnostic phase includes both the identification of constraints/potentials and the research planning phase in which constraints and opportunities are analyzed and research priorities determined.

Diagnosis should be an interactive process; it begins with an initial diagnosis but develops during the research process, as more information of farming systems becomes available. The emphasis of the cases presented in this guide is on the initial diagnostic phase, where the main objective is the identification of priority topics for the first cycle of on-farm research.

In addition to the identification of research topics, an initial diagnosis has other, less widely reorganized objectives. It should provide disciplinary or commodity research with new research questions. Based on the technology constraints faced by farmers and It should provide other, primarily, governmental institutions with policy-relevant information constraints and preconditions required for the promotion of agricultural development (such as extension and inputs). The selection of the target area may be based on a preliminary agro-ecological zonation carried out by the research team, but this information is usually made by government policy makers. When donor-supported programs are involved, donors also generally have a voice in the selection of the target area.

(2) Activities in Diagnostic Phase

As in other diagnostic studies, the sequence of information gathering for livestock studies generally begins with the collection and analysis of secondary data, followed by informal and formal surveys. The final step is the identification of constraints, possible solutions and prioritization of research topics. In this process, the specific tasks carried out in each step are strongly influenced by the results of the preceding step.

2.3.7 Secondary Information

Collection and analysis of secondary data should be the first step in a diagnostic study. In several case studies, fieldwork started without the analysis of secondary information. However, teams who did carry out this step get helped a great deal in defining what information needed to be collected during the informal survey. During a preliminary analysis based on secondary data, hypotheses about constraints and opportunities can be formulated. The informal survey can then be planned to test these hypotheses and to supplement the

available information. This provides a clear focus for the survey. Simply having team members read reports will not have the desired result. Teams will need to work together to analyze the available information. Generally, one to three weeks is required for secondary data collection and analysis, depending on how much prior work has been done to compile a bibliography on agriculture in the area (and livestock keeping in particular).

Adequate use should be made of secondary information. It is cheap, and using it encourages researchers to recognize and build upon work done in the past. Secondary information may come from regional and local institutions, as well as results for past research and development projects. Such information may provide general characteristics of the study area, including agricultural policies, socio-cultural information, agro-physical (climate, topography, soils), agro-biological (crops, livestock, their nutrition and diseases) and agro-economic (crop and livestock inputs and outputs, marketing) data: physical and institutional infrastructure, along with assessment of production problems and results of past livestock research. However, the reliability of secondary information and particularly of census data should be critically assessed.

2.3.8 Informal Surveys

Informal surveys can be used to confirm and complement the initial ‘systems understanding’ developed on the basis of the literature studies. Informal surveys are conducted using direct field observations and interviews with farm families and key informants (such as local leaders and traders). The main technique is the open-ended interview: researchers do not follow a set questionnaire, but may use checklists. Interview topics evolve as fieldwork progresses and as understanding of the farming system emerges. In recent years much emphasis has been placed on the involvement of farmers in identification of problems and solutions which has resulted in the development of participatory rapid appraisals. The findings of the informal survey should indicate whether or not a formal survey is needed; if the answer is yes, the information provided by the informal survey should make it possible to clearly state the objectives of the formal survey. In other words, the informal survey provides, in large measure, the research questions to be addressed in the formal survey.

(1) Characteristics of an Informal Survey

The aim of an informal livestock survey should be understanding, rather than data collection: understanding the role of livestock in the farming system, and understanding the dynamics and variability of livestock keeping. Dynamics and variability need to be understood not just in terms of animal productivity, but

also with respect to factors like animal husbandry practices, the importance of livestock for different types of households, and availability of forage.

(2) The Research Team

A multi-disciplinary team that works in an inter-disciplinary manner should be the norm. Many teams are narrow in composition or do not manage to get away from a narrow disciplinary focus. Minimally, an agronomist and a socio-economist should be part of any team carrying out a diagnostic livestock survey; a veterinarian and a person with broad knowledge of vegetation and soils are valuable additions. Arranging for the participation of extension workers and subject-matter specialists within the department of agriculture and the veterinary service is important. Not only can they provide an introduction to the village and share their knowledge of the area, but their inclusion also paves the way for obtaining their support for later work. In implementing on-farm trials and creating effective research-extension linkages, it is essential to have had such involvement from the very start of the research programme. The presence of women, including some older women, in the survey team is also important. Not only is their participation valuable, but also in many cultures women farmers will speak more freely in the absence of men. Further, women team members contribute their own specific knowledge of and interest in major components of the farming system. Participatory fieldwork techniques (mapping, transect walks, activity/resource calendars) and participatory discussion analysis sessions (such as joint writing, and analysis of constraints) may improve collaboration within the team. A skilled team leader is needed, however, to apply these techniques and foster inter-disciplinary cooperation.

If the results of the informal survey are to be valid, the people interviewed must be representative of those the project may want to involve. Several case studies show, however, a strong bias towards male cattle owners, often heads of households, in their choice of farmers to be interviewed by survey teams. This is not apt to provide good understanding of livestock keeping for these various categories of farmers to be interviewed. Women must be included in the discussions: they have specific information to provide. Also, they may have different viewpoints on these matters than men. Depending on the cultural context and the sensitivity of the points to be discussed, separate discussion groups may have to be formed during the survey for women and for men. Households headed by women often form a rather large group. They should not be overlooked, because their problems and possibilities in missing livestock may be quite different from those of male-headed households.

Among the others who should be specifically included in the interviews are

older farmers (both men and women), since they can give a picture of the developments in land use for the last decades, their causes and their impact (for example, on grassland availability). Herders, often young boys, are another interesting group. They are often better informed about the daily management and behavior of the animals than the owners, who are generally heads of households and less occupied with the daily care of their animals.

Households owning very few or no animals are rarely considered in livestock surveys. They do, however, form an important category because they can provide a clearer understanding of the role of livestock in the farming system (what are the differences in functioning between a household owning cattle and one having no cattle), and can improve the understanding of crop-livestock interactions. For newly established households, not having livestock may be a temporary situation. On the other hand, not all households that keep livestock are the owners of these animals. In most societies there are several types of lending arrangements.

A final category of people to seek out in the village is that of 'key informants'. These are people who can provide valuable information on a number of very specific points. Among those who might be considered key informants are village leaders, members of special village committees, the village extension worker, local butcher, traditional livestock healer, local livestock traders, and dip attendants. This list of possible discussion partners during fieldwork in the villages is not exhaustive, nor is it intended to suggest that all should be visited in every case. The survey team should determine which subjects to discuss with which categories of farmers. To allow time meet various categories of farmers, a stay of two to three days per village is recommended. This also allows the necessary flexibility in the programme: the strict time schedule necessitated by a one-day visit will not work and is not in line with the informal nature of the survey.

The contacts made during the informal survey can be a great help not only in collecting information but also in helping to ensure later implementation. By keeping people informed of progress of the study, a team can keep up their interest and commitment, which will eventually contribute to the adoption of any recommendations that emerge.

(3) Methods of Data Collection

Direct observation in the field combined with informal questions and discussion with farmers is the most basic method in any diagnostic study.

2.3.9 The Use of Checklist

The checklist, as used in an informal survey, is a guideline that allows open discussion with the person being interviewed, in search of interesting information on a number of major subjects. Checklists take the place of the questionnaires used for structured interviews. Discussion and probing is more important than a simple answer to a question posed by a team member. There is nothing new in this idea; however, experience shows that, it is often not easy to put into practice. The main reason is, probably, that most researchers and extension workers are more used to 'telling and asking' than to 'discussing arid listening, particularly with respect to farmers. To improve communication techniques during informal surveys and other interactions, training can be arranged to help team members learn to introduce the team in a village, make use of checklists in individual and group discussions, and combine direct observation with interviews. Since owners consider some information on animal production to be quite sensitive-such as livestock ownership, lending arrangements, and traditional veterinary practices-ways to deal with questions in these areas should be a point of particular attention. The list of points on which a team needs to search for information will be long. It will not be possible to deal with all the points in one single discussion, nor can good information on all of the various points be provided by a single category of farmers (e.g. cattle-owning men). This implies that, more than one checklist will be needed, and that farmers' representative of all of the potential target groups or recommendation domains should be included. Further, informal surveys should not be rigidly structured with respect to the sequence of activities, and should allow sufficient room for farmers to express their feelings, wishes, concerns, and hospitality, to pose questions, or to test the knowledge and skills of the 'livestock experts'. Allowing enough time for completing the informal survey can be an important part of the process, since careful exploration of farmer's questions and comments may provide information that is vital to the project.

2.3.10 Participatory Rapid Appraisal

A participatory rapid appraisal will combine several of the methods. The transect walk is a very valuable method in this respect: it involves a systematic walk through the area, seeing as much as possible of the variability in land use. This usually means one cuts across the topography, from hill tops to valley bottoms. It is helpful to have a few knowledgeable farmers accompany the group. During the walk, the team observes differences in land use, farming practices, relevant features for livestock keeping; informal discussions take place with the accompanying farmers and people met during the walk. To allow for maximum coverage (including a visit to sometimes distant grazing areas)

and facilitate informal meetings with farmers, the team may need to be divided into groups. These should be small and, as far as possible. Combining the results of transect walks, resource mapping, and flow charts provides a strong analytical tool. Linking charts to maps and transect diagrams makes it possible to visualize interactions.

2.3.11 Kraal Visits

Kraal visits (also referred to as animal biographies, herder recall, or in a somewhat narrower sense progeny histories) is one of the few tools used specifically in livestock systems diagnosis. The survey team visits a livestock kraal to observe and have informal talks with the owner (or keeper) and the herder, as the latter is likely to have more accurate information on aspects such as disease occurrence and livestock productivity. In this way the team can obtain an impression of livestock numbers, herd/flock composition, condition of animals, and livestock productivity. For example, to get an idea of productivity, one can ask about the performance of a few individual animals (age, number of offspring, age and condition of most recent offspring, milk yield). Although this does not give a 'precise' quantified picture, the information is valuable, and most likely will lead to new observations and questions. Kraal visits can be combined with transect walks.

2.3.12 Wealth Ranking

To obtain insight into wealth or socio-economic categories in a village, a wealth-ranking exercise can be conducted during participatory rapid appraisal. This allows the team to become aware of how attitudes, decision making, and production priorities are affected by wealth, and provides a basis for the identification of target groups for future research and development activities. Livestock ownership often plays a dominant role in wealth ranking. None of the case studies mentions the use of a wealth-ranking method; most cases different socio economic categories we distinguished by researcher categorization or by applying farmer categories a project had distinguished in earlier years.

2.3.13 Analysis of Data, Debriefing and Report Writing

Analysis of the information collected should not be put off until after fieldwork is finished; instead, this should be a continuous process. At the end of each day of fieldwork, team members should briefly discuss the findings: because the team usually splits into smaller groups while working in villages. These daily discussions are necessary to keep the whole team well informed. These evening meetings may seem tiresome, but they are important not just to

inform, but also to do some preliminary analysis, testing of the hypothesis, and answering the questions formulated at the beginning of the survey. This makes it possible to identify topics for which insufficient or contradictory information has been collected, and to briefly evaluate the functioning of the team and the use of survey tools. This enables the team to maintain a clear focus. Based on these discussions, the checklist can be adjusted and changes can be made in the programme for the subsequent days of fieldwork. If travel distances and fatigue make evening discussions infeasible, a team meeting lasting one full day is to be recommended, after the fieldwork in a village has been finished.

Writing the final analysis, including the identification of constraints and priority research topics, and discussing the need for a formal survey to verify or quantify some topics, is often left up to a very small group of people. This may lead to a final product of less than optimal quality, since it makes no use of the knowledge of most team members. It may even jeopardize future collaboration with both farmers and other important actors, such as the extension service workers: when they do not participate in the final analysis and priority setting for research, they are less apt to understand and be committed to the results. Involving the complete team in the final analysis is therefore strongly encouraged. Such participation of all team members can be enhanced by using techniques that make it easy to visualize the analysis. Use can be made of the maps, flow charts, and diagrams made during fieldwork.

It is preferable to think through the planning method to be used. Unfortunately, none of the models now available seem to completely meet the needs of projects; perhaps, they are not well enough understood, but also, as mentioned in the introduction, they often call for unrealistic quantification or expertise that is not available. The results of the analysis should be verified in debriefing meetings in the villages where the fieldwork has taken place. Debriefings should be well-prepared meetings where survey findings are discussed with farmers. If the team decides to conduct on-farm trials in these villages, such meetings can also be successfully used to plan the first trials. When survey findings and proposals for future action are to be presented to district or regional institutions, small one-day workshops have proved to be particularly valuable. When the time comes to produce a survey report, teams often find writing a difficult exercise. It is time consuming, few of the team members are generally seen as good writers, and the written product does not always sufficiently reflect the information collected. A well-structured analysis of survey findings can facilitate writing the report, since many of the essential topics will already have been thoroughly discussed, and a structure will have been developed that can also be used in writing the final chapters, including the

analysis and identification of research priorities.

2.3.14 Duration

An informal survey in one agro-ecological zone, which takes into account the issues discussed here, will take 14 to 16 weeks. This assumes a team of moderate size (ten persons), which visits three to five villages, staying in each one for two or three days. Survey preparations take two to four weeks, fieldwork takes three to five weeks; team analysis, debriefings and a one-day workshop require three weeks, and report writing needs three to four weeks (assuming that some reporting is done during the analysis).

(1) Formal Surveys

Formal surveys, provide a quantitative basis for conclusions drawn during earlier phases, but could also be used to redefine target groups (or recommendation domains), and to test hypothesis about relationships. The main technique is the structured interview, using a questionnaire. The survey may be carried out during one or more visits. Multiple visits may take place at irregular or regular intervals; herd monitoring to collect data on livestock productivity parameters, for example, can best be done with regular visits.

Formal surveys impose relatively high financial, time, and manpower requirements, they should, therefore, only be carried out when the outcome of an informal survey indicates a need for further research. Before embarking on extensive data collection, it is useful for researchers to ask themselves the following questions: What is the purpose of the survey? What are the types of data that can be collected consistent with this purpose? Are the methods to be used to collect data appropriate to the circumstances and the type of data required? The concluding question is, whether the costs of carrying out an extensive formal survey are matched by sufficient benefits.

(2) Research Planning

It is vital to plan based on careful analysis of the survey results. This is done during the research planning process, a critical part of the research process that often receives insufficient attention. Research planning, including the identification of research priorities, is based on a series of steps which correspond roughly with the terms problems (what is wrong), causes (why) and solutions (what can be done), followed by ranking of the problems and solutions. As the number of problems exceeds the research capacity of the team, problems must be ranked according to relative importance. Criteria usually used include, how many farmers does the problem affects? How frequently does it occur?

What loss in yield or income does it cause?

Before examining possible solutions, the interactions among problems and causes (biophysical, socioeconomic or cultural) need to be examined. Potential solutions should then be sought for problems for which the probable causes are understood. Potential solutions may come from past research or from research results reported in the literature. It is very important for the research team to listen carefully to farmers who can provide essential local knowledge regarding the feasibility of potential solutions. As for problems, it is necessary to rank and evaluate potential solutions and how much time and other resources would be required to test potential solutions. Finally, priorities for research must be set, based on the earlier analysis of problems and solutions. In fact, priority setting is a complex process, because of the many actors who need to be involved. Problems and solutions are often diverse; varying in complexity, level, and extent to which they can be quantified and different actors may have very different ideas about them. A partial solution is to divide problems and solutions into groups and prioritize them into these groups, for example, livestock problems and crop-related problems but consensus will remain an essential part of the process. Agreement is needed on operational definitions for project objectives, on criteria, and on the relative importance of criteria. Further development of methodologies for priority setting is needed, including ways to involve farmers. To date, the planning techniques afore mentioned have been primarily used by researchers.

(3) Research Methods and Tools

In the course of the research process, beginning with the initial diagnostic studies, information is collected and analyzed, and decisions are made regarding the research priorities. The research methods and tools to be used must be selected to match the situation. In choosing methods, the reliability of the data collected and whether data will be available at the appropriate time are important considerations, but many other factors also play a role. Two significant factors discussed below are farmer participation and the need to adopt research methodology according to the resource of national search programmes.

(4) Farmer Participation

Farmers frequently participate in diagnosis as survey respondents but instances of farmer-researcher collaboration have been limited. There is often a sort of doctor-patient relationship; researchers consult farmers, diagnose their problems, and try to find solutions. Nevertheless, in recent years substantial efforts have been made to increase participation of farmers in the research

process. They are no longer seen as simply a source of information, but are consulted and increasingly involved in decision making about research priorities, trial design, implementation, and evaluation. This has important consequences for the choice of research methodologies. For example, in the diagnostic phase, the emphasis has changed from formal to informal surveys, in which participatory rural appraisals are an important component. Few of these methods apply only to animal production: most are applicable to other farm enterprises as well. However, even far better developed participatory rapid appraisal methods cannot fully replace more conventional formal survey methods. Where more detailed quantified information is required, formal surveys may still be the most suitable.

(5) Adapting Research Methodology

Research methodologies should be adapted to suit the resources and expertise available in national research programs. This also suggests a careful look at how quantitative the data collected need to be. In most African countries, financial resources for research are very scarce, producing a realistic and useful analysis and identifying research priorities does not require knowing everything about a farming system or its livestock component. In livestock research, there is still scope for evolving appropriate methods that are cost-efficient and based on defining the key information and degree of understanding required. Although participatory research can be expensive especially in terms of time commitment for researchers and clients, its use in the diagnostic phase is likely to be less expensive than diagnostic studies based on formal surveys. Good communication forms the basis for participatory research. This and other facets of participatory diagnostic methods require particular skills: training will be needed for researchers, extension workers, and other members of the survey team. A good attitude towards working with farmers is also essential.

At this point, it is probably clear that no one combination of methods and tool can always be applied in diagnostic livestock studies. And, in addition to the important factors that have been discussed, others, such as the time available for the study and the size and heterogeneity of the study area, have not been dealt with. In addition to skilled, experienced researchers, methods for creating this linkage will need to be developed in all of these areas. There is still room to develop and adopt new diagnostic methods and tools for livestock systems search.

2.3.15 Statistical Analysis

This is defined as the refinement and manipulation of data in order to prepare

them for the application of logical inference. Statistical analysis is divided into descriptive and inferential statistics. Descriptive statistics is used in research for the purposes of bringing the data into order i.e. data preparation, tabulation and summarization which could either be qualitative or quantitative. Frequency distribution and percentages, histogram, frequency polygon, ogive, percentiles and averages are used in descriptive statistics.

2.3.16 Data Analysis

Data is defined as quantitative information in its raw form. Analysis may be defined as breaking down and ordering of the quantitative information gathered through research or some other means of data gathering. It involves searching for trends and patterns of associations and relationships among these data. Data generated can be subjected to statistical test to tell whether a variable has an effect on something. It can also reveal the relationships, correlations and interactions of two or more parameters or characters. The statistical techniques usually used in the analysis of data for agricultural based researches include: ANOVA, Chi-Square and T-test, Correlation, Regression etc. At times, simple descriptive statistics such as percentages, frequencies and averages are also used to express the level of effect, incidence, prevalence and frequency of occurrences of something. A researcher should also know how and when to use SD, SE, SED, r and r^2 values.

2.4 Results and Discussion

The results basically deal with what happened in your experiment, that is the new findings and discoveries form the researcher's results. It is usually presented in chapter four of the project work. Results may be presented making no comments on them. The interpretation is later given in the discussion section. Interpretation is the explanation of the association and relationships found among the data or groups of data. This also may include inferences and conclusions drawn from these relationships discovered among the data or groups of data.

Another approach is to interpret the results up to a point to make some connections between the different statements, such as the significant levels ($P<0.01$ or $P<0.05$) or not significant ($P>0.05$) and the correlation levels (positive or negative etc.) but give more detail in a separate discussion section. However, the basis of research is the ability of the researcher to design, conduct experiment, collect data, analyze the data, interpret the results, discuss, conclude and make recommendations for implementation.

A third way is to combine the results with a discussion of each point. This last method will work best in a short and simple experiment. It is usually easier to follow the results if the researcher presents them in the same order as he/she gave the objectives in the introduction. Well-presented results are simply and clearly stated and reports representative data rather than endlessly repetitive data, reduce, large masses of data to means or averages, along with the standard error or standard deviation. Report repetitive data in tables and graphs, not in the text, repeat in the text only the most important findings shown in tables and graphs. Include negative data, which is what was not found, if they affect the interpretation of the results and give only data that relate to the subject of the work as defined in the introduction. Refer in the text to every table and figure by number; include only tables, figures and graphs that are necessary, clear and worth reproducing. Avoid repetition of data, unnecessary negative data, unnecessary figures or graphs, unnecessary words. Under this section, a researcher may present all the relevant results in this manner:

2.4.1 Presentation of the Results Using Tables or Figures

The results determine the mode of presentation (that is either to use Tables or Figures). Tables are systematic arrangement of data or information in a format that allows the reader to easily observe variations or trends and make comparisons. Data that have been collected and analyzed in a scientific investigation are presented in the Results section. These data represent the research findings and may be presented as tables. Tables are good for presenting precise numerical data. When making comparison of treatments, tables are better used, especially where the exact value is important and since the final values from these should appear close together. Tables are prepared or drawn in rows and columns with titles, column and headings on top of the tables. Some tables contain footnotes at the bottom. Some schools and journal companies allow the use of vertical and horizontal lines within the tables while others do not allow those vertical and horizontal lines apart from the two horizontal lines that separate the titles and sub-titles and the bottom horizontal lines that separate the data with the keys or legends. Tables are numbered 1, 2 and 3 etc. for self-explanation. When preparing tables, the titles should be in sentence case or most often in title case format.

Illustrations or figures are visual patterns used to present information or data. They are frequently used in presenting research data because they present information in a way that is easy to read and understand. Illustrations are often referred to as figures which are meant to present data vividly; they must be simple and clear with relevant legends so that readers can immediately get the message. The major advantage of illustrations is that they present information in

a form which otherwise would need many words to explain. Remember the old saying, 'A picture is worth a thousand words'.

Line graphs demonstrate relationships among data or dynamic comparisons. Graphs are best for illustrating trends and relationships among sets of variables. If the researcher is showing trends or gross changes then a graph will have the most effect. Do not use graphs to duplicate information already in the tables or text. Bar and pictorial graphs compare quantities. Pie charts show proportions of a whole. Photographs are accurate representations taken with a camera. They give vivid evidence of research findings. Describe the overall results and not each individual values. Flow charts show a complicated process or system. Maps may show the distribution of quantitative or qualitative data or illustrate research sites or other locales. Line drawings illustrate objects, specimens or represent data. A researcher should not ignore Tables and Figures and their units of measurements. A researcher should make sure he/she mentions every one of them in the text. Preferably every table, graph, photograph and figure is on a separate page. These are usually presented after references at the last page of the work. But, this again, depends on the particular institution and journal because some allow presentation of tables and figures in the text together with results and discussion.

Examples of tables and Figures:

Table 1. *Comparison of the Physico-Chemical Characteristics of Otamiri River, Imo State, Nigeria Treated with Alum and 2 Gram/10 Liters of some Tropical Plant Seeds for 1 Hour.*

Parameters	WHO STD	Raw Sample	Alum Treated	MOT 2g/1hr	ABT 2g/1hr	ZMT 2g/1hr	TTT 2g/1hr
Temperature	20-30	23.0	22.3	20.0	21.3	21.3	21.7
pH	6.5-8.5	5.24	3.66	4.77	5.12	4.86	4.98
TDS (MG/L)	250	61	61	60	48	58	44
TSS (mg/l)	50	32	16	38	18	24	23
Color (PLCO)	15	44	33	128	89	131	119
Turbidity (NTU)	50	58	20	50	40	39	41
Appearance	Clear	Clear	Clear	Milky	Slightly Clear	Slightly Clear	Slightly Clear
Odor	Odorless	Odorless	Odorless	Odorless	Odorless	Slight Odor	Slight Odor
Taste	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
Nitrate (mg/l)	40	0.2	0.1	0.2	0.2	0.1	0.2
Iron (mg/l)	1.0	0.70	0.67	0.21	0.01	0.09	0.05
Copper (mg/l)	0.3	0.00	0.13	0.10	0.03	0.06	0.03
Conductivity	100	122	122	120	97	119	87

Table 2. *Comparison of the Physico-Chemical Characteristics of Otamiri River, Imo State, Nigeria Treated with Alum and 2 Gram/10 Liters of some Tropical Plant Seeds for 24 Hours.*

Parameters	WHO STD	Raw Sample	Alum Treated	MOT 2g/24hrs	ZMT 2g/24hrs	ABT 2g/24hrs	TTT 2g/24hrs
Temperature	20-30	23.0	22.3	22.9	23.0	22.8	22.9
pH	6.5-8.5	5.24	3.66	4.83	5.15	5.13	5.05
TDS (MG/L)	250	61	61	43	34	34	34
TSS (mg/l)	50	32	16	10	26	35	41
Color (PLCO)	15	44	33	84	139	150	165
Turbidity (NTU)	50	58	20	18	48	57	38
Appearance	Clear	Clear	Clear	Clear	Slightly Clear	Slightly Clear	Slightly Clear
Odor	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless
Taste	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
Nitrate (mg/l)	40	0.2	0.1	0.1	0.2	0.4	0.2
Iron (mg/l)	1.0	0.70	0.67	0.07	0.0	0.13	0.29
Copper (mg/l)	0.3	0.00	0.13	0.14	0.03	0.09	0.07
Conductivity	100	122	122	85	67	68	67

Table 3. *Progesterone Concentration of Non-cyclic RB (ng/ml) in Adamawa State, Nigeria.*

Weeks	*Mean*	*SE M*	
1	22.800	0.2757	1 VS 2 ns P>0.05
2	23.000	0.1826	1 VS 3 * P<0.05
3	23.700	0.2556	2 VS 3 ns P>0.05

Figure 1. *The Use of Oxen for Pre - and Post-Emergence Weeding of Farm Lands in North Eastern Nigeria.*

Figure 2. *Natural Calf Rearing in Lala District, Gombi Local Government Area, Adamawa State, Nigeria.*

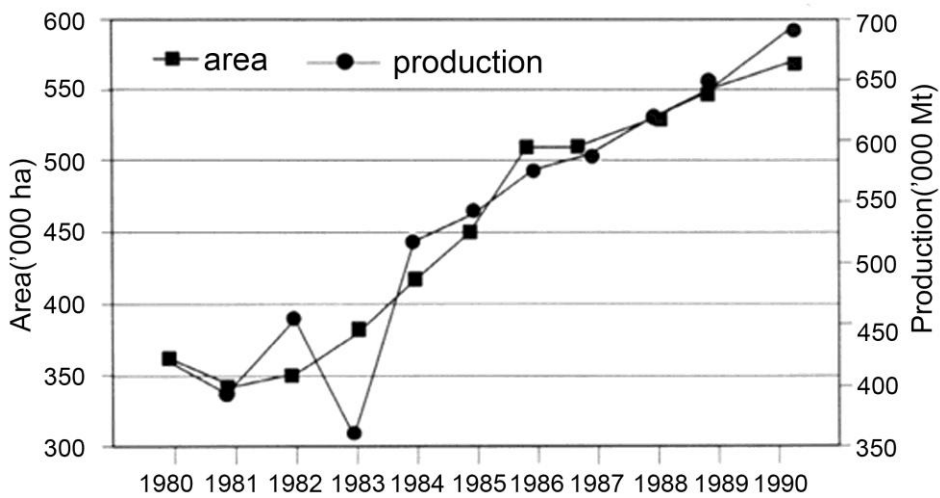

Figure 3. *Line Graphs Illustrating Relationships and Making Comparisons between Rice Production and Land Area in Côte d'Ivoire.*

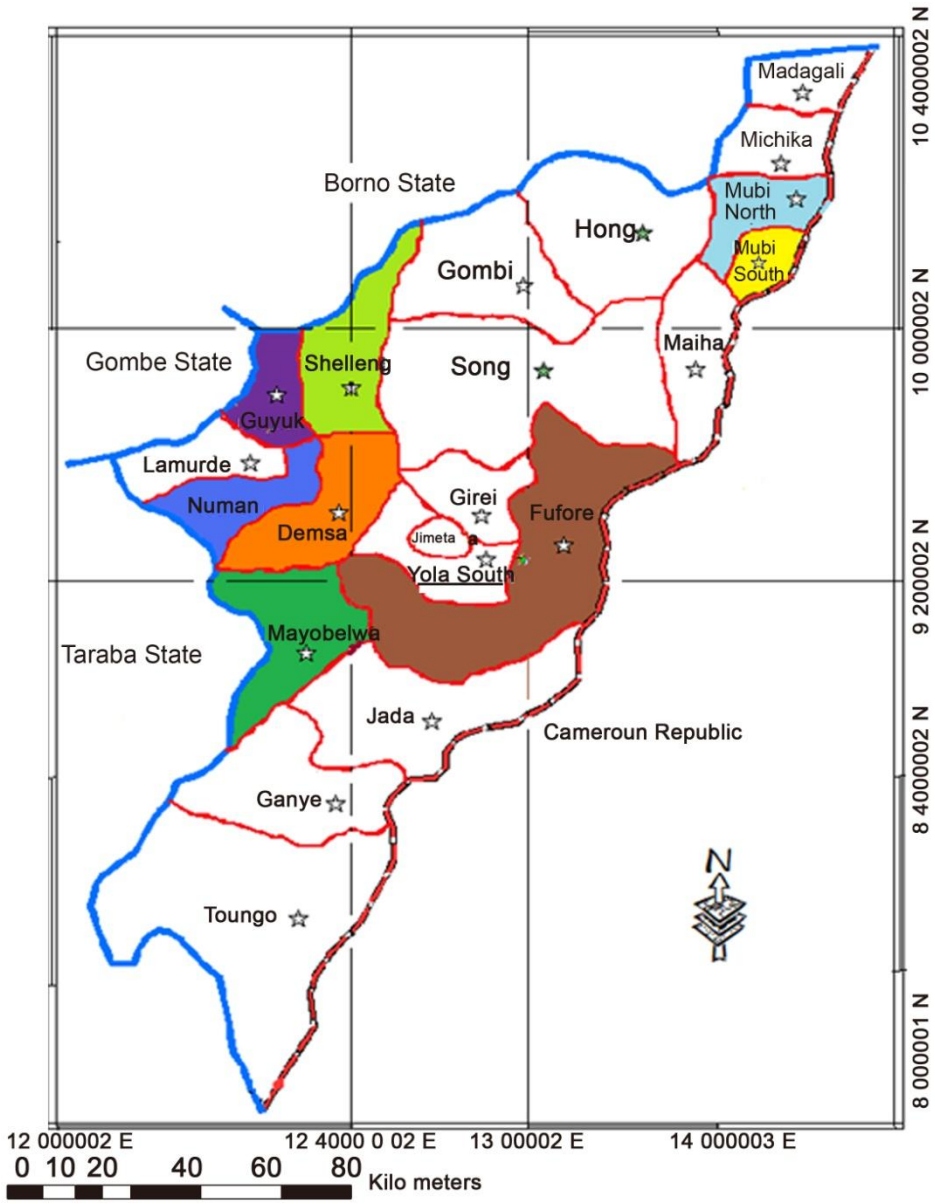

Figure 4. *Map of Adamawa State Showing the 1 3 Uncoloured Local Government Councils as Study Areas.*

2.4.2 Discussion

In the discussion section, a researcher must answer questions such as: What do my results mean? And what are their implications? This is the most important and demanding section of the work. A researcher must interpret his/her results for the readers so that they can understand the meaning of his/her findings. There must be clear relationship drawn to previous works. Here, a researcher can discuss why some things happened and why some things did not happen and the variation seen in his/her results in relation to others. A researcher can, also, discuss the relevance of his/her research work to the specific fields; point out how it relates to other fields and make recommendations from his/her work and point out possible avenues of further research. The researcher should relate his/her findings to previous work and if they do not agree with his/her work then consider and tell the reasons why. Tell readers the significance of the study to members of the community or to other researchers. The researcher should make sure that he/she deals with each of the originally stated objectives and follow the order of original objectives. The discussion section has three parts:

a. The facts a researcher has found or discovered;
b. His/her commentary on the facts, and
c. The theoretical implementation of the facts.

2.5 Summary

This section clearly summarizes the important findings of the study. It should be brief but contain the results presented and possibly the significance of the results and its interpretation. Summary of a research work titled: *Rainwater Harnessing and Harvesting for Domestic and Agricultural Purposes in Nigeria* should take this form: The results show that 80% of respondents had sufficient rainwater while 20% had mixed reactions in terms of sufficiency of harvested rainwater for domestic and agricultural uses. It was also observed that, most times, the rains fall when members of some families were still at their farms and so could not have the opportunity to harvest and store rainwater on every rainy day. The results also show that 90% of the respondents use rainwater for domestic chores with only 10% using the first dirty rainwater collected to irrigate small backyard vegetable gardens, banana, pawpaw and oranges that are usually planted within the compounds near where clay water pots are kept. Average temperatures for each of the three months were 27, 25 and 26^{o}C respectively. The Colour had 5, 5 and 5 values. Turbidity was 0.15, 0.16 and 0.15, P^{H} Value was 6.9, 6.9 and 6.7, Chlorine had 0.1, 0.1 and 0.2 and Chloride

was 16, 14 and 18. Free CO_2 were 8, 9 and 10, total Acidity were 8, 11 and 14 and total Hardness were 19, 14 and 12. Calcium Hardness were 12, 8 and 6, Magnesium Hardness were 35, 30 and 25, Alkalinity were 14, 26 and 30, and Nitrate were 19, 18 and 20.

This summary usually comes under chapter five of the project work or thesis together with conclusion and recommendations.

2.6 Conclusion

If a researcher's results and subsequent discussion have been especially complicated, it may be useful in conclusion to bring all his/her findings together in consolidated whole with clear inferences drawn.

Example I: Conclusion of a research work titled: *Rainwater Harnessing and Harvesting for Domestic and Agricultural Purposes in Nigeria* should take this form: Rainwater harnessing, harvesting and storing was found to be a simple low-cost technique that can do much to alleviate water shortages in areas where pipe borne water is unavailable, expensive or unreliable. Yet in Nigeria it is often overlooked as a strategy, partly due to lack of information, orientation, awareness and laziness.

Example 2: Conclusion of a research work titled: Incidence of Repeat Breeding Syndrome in Cattle Herds in Four Selected Local Government Areas of Adamawa State: It was concluded that, the incidence of repeat breeding syndrome is a worldwide phenomenon and has led to a huge economic waste in the cattle industry in these areas since the animals had repeated services with wide calving intervals, reduced milk production and increased culling rates. The animals had normal reproductive tracts with normal progesterone concentration which could have not influenced the repeat breeding syndrome. Therefore, since Repeat Breeding syndrome is a multi-factorial condition, the possible risk factors could be poor management, season, error in heat detection, wrong time of service and other environmental imperfects. It is not justifiable to cull the animals from the herds because most of them are not sterile but have lowered fertility.

Example 3: Conclusion of a review article titled: Current Approaches to the Determination of Feed Intake and Digestibility in Ruminant Animals: Since evaluation of preferred forage will continue to be important in grazing lands development, it is necessary to spatially separate the forages being evaluated to eliminate the constraints that occur within an intimately mixed sward. This is

most critical for researchers in regions which are trying to move from traditional extensive pastoral practices to some form of semi-sedentary production of ruminants under a managed field. As these reviewed novel approaches continue to evolve, it is expected that they will become simplified and cost effective and, therefore, find wider applications in agriculture and diagnostic research.

2.7 Recommendations

This section tries to highlight unanswered questions and recommend for further investigation. It also provides suggestions which when adhered to will provide solutions to the discovered problem. This section also states how the results of this study may be implemented or utilized by the relevant/concerned community, governments, agencies, organizations or institutions.

Example 1: Recommendations of a conducted research work titled: *Rainwater Harnessing and Harvesting for Domestic and Agricultural Purposes in Nigeria*: It was recommended that, people should be given orientation and awareness on how to tap and harvest richly from nature, the need and the importance of rainwater for domestic and agricultural purposes throughout dry seasons. Any surface or paved areas can be treated as catchments. Even the footpaths and roads can act as catchments as these areas too receive the direct rainfall. Rooftops are the best among them because of the large coefficient of run off generated from them and there are low chances of water contamination. Conveyance system includes rain gutters and down pipes which collects the rain water from catchments to the storage tank. They need to be designed appropriately as to avoid the loss of water during the conveyance process. In those areas which receive rainfall frequently, their storage systems could be constructed to meet the daily water requirements. One should make sure that the storage system is properly sealed and does not leak. Use Chlorine from time to time to keep the water clean. Storage tanks should be covered to prevent mosquito breeding and to reduce evaporation losses, contamination and algal growth.

Example 2: Recommendations of a conducted research work titled: *Incidence of Repeat Breeding Syndrome in Cattle Herds in Four Selected Local Government Areas of Adamawa State* are written as: It was recommended that, to identify repeat breeder animals, two things are needed: good records and good heat detection. On many farms the efficiency of estrous detection is less than 60%, i.e. for every 10 animals potentially cycling only 6 are served. However, if done well they allow the farmer or herdsperson to pick up animals that are cycling normally but not getting pregnant or most importantly those not

fitting a normal pattern. Using this information, these possible problem animals can be identified quickly, subjected to veterinary examination and a treatment protocol applied. This reduces the potential days open and so saves money. Good records have two values. First, they need to be referred to easily and quickly. A notebook or breeding calendar is often better than a computer as a means of reference or "action list", as it is usually nearer to the animals. Good heat detection needs an ability to recognize the signs of heat and time set aside to look carefully for these as in some cases they may not be very obvious.

The 3-week calendar can be very useful in pinpointing likely candidates. Other aids, such as beacons, tail paint pedometers and milk progesterone can also improve heat detection but there is still no really cost effective substitute for the astute observer apart from the bull. If only the repeat breeders and other animals with reproductive problems can be identified, there could be treatment and preventive measures taken. If regular veterinary fertility visits are not used, then animals that have had three services and are not pregnant should be checked before serving again. Many studies have shown that the treatment of repeat breeder cows, even those that are apparently normal, does save money. They also show that it is those farms with good records and good breeding plans that save the most as they use the veterinary input most efficiently. The management and treatment of repeat breeders should form a significant part of the fertility section of your herd health plan. To prevent repeat breeding syndrome in cattle; ensure you are serving animals at the correct time. This means that all staff should know the signs of heat. Milk progesterone testing is also useful; animals in a true heat will have very low progesterone. Ensure insemination techniques are as good as possible. This is, particularly, important if you use A.I., do not serve animals previously diagnosed as pregnant without doing a cow – side progesterone test to confirm it has low progesterone and is not pregnant. If the animal is pregnant, A.I. may cause foetal loss. Identify and treat cows with whites before starting to serve them. Don't start serving too soon after calving. Herds that start early have lower pregnancy rates to service and so more repeat breeder cows. Minimize stress at service. For example, try and avoid serving around turnout or when changing the diet. Therapeutic use of GnRH and PGF2α for repeat breeders is recommended for improvement in pregnancy rate.

2.8 Arrangement of Chapters in Project Writing

(1) Chapter One: Introduction

1.1 Background of the Study.

1.2 Statement of the Problem.
1.3 General Objectives of the Study.
1.4 Specific Objectives of the Study.
1.5 Scope of the study.
1.6 Justification of the Study.

(2) Chapter Two: Review of Literature

2.1 Brief historical background.
2.2 Related research works done by other people, etc.

(3) Chapter Three: Materials and Methods

3.1 Location of the Study Area.
3.2 Experimental Design.
3.3 Data Collection.
3.4 Data Analysis.

(4) Chapter Four: Results and Discussion

Table 1: Systematic presentation of results based on how they were conducted or obtained and discussing them in comparison to other reported findings, etc.

Table 2: Some aspect of the results based on parameters measured, etc.

(5) Chapter Five: Summary, Conclusion and Recommendations

5.1 Summary.
5.2 Conclusion.
5.3 Recommendations.

Chapter 3: Guide III

3.1 Journal Article Writing

The purpose of a research article is to publish scientific paper that communicates new findings and original information to readers. The research paper takes a hypothesis that has been tested by experimental methods to come to conclusions. Research article is the most common organ of communication in the academic community. Specialists in the field will want to read the entire paper to digest and comprehend the information. Other casual readers will only be interested in the results, or perhaps the experimental methodology employed, as background to the reader's own work.

3.1.1 Choosing Preferred Journal

Before a researcher starts preparing an article for pagination, he/she should target a journal in which his/her paper will be published. His/her ability to choose a good reputable journal will also influence the format and style of his/her article. Different journals have different styles and different rules of presentation for the material they publish. Many journals nowadays receive more papers than they can process, the best and reputable journals have high rate of rejected manuscripts. Only fake and profit driven journals accept every manuscript sent to them because they are after the pagination fee not the contribution to knowledge. If a researcher is a beginner, he/she stands a better chance of having his/her paper accepted in less reputable journals. It requires more effort to write a quality paper for an international journal, but the rewards are also greater because greater number of readers will come across his/her paper if it appears in an international journal. On the other hand, local journals need the support of good scientists and writers to increase their value and readership.

He/she must weigh these issues before making a choice. Is his/her paper of sufficient merit and of sufficient interest to a broad audience to send it to the very best journal? If not, it is better to send it to a less well-known journal, where he/she may have a better chance of getting it accepted.

3.1.2 The Scope and Aims of the Journal

A statement of a journal's purpose and scope is usually printed on the inside of the cover of the journal. Read it carefully. There is no point sending a research paper to a journal that only publishes review articles; nor is there any need sending a theoretical paper to a journal that only publishes practical research.

3.1.3 Frequency of Publication

Journal publication is usually a slow process, and a journal that is published twice a year will take much longer to publish an article than a journal that appears once every two weeks. Researcher should ask himself/herself, Will a 12-month publication affect the relevance of his/her paper?' If the article is required to be published quickly, send it to a journal that can publish it quickly; if rapid publication is not essential, the editors of a fortnightly journal are likely to reject your paper, in any case.

3.1.4 Type of Articles to be Published

Many journals require a specific format for the articles they publish. If your article does not fit this format, the paper may be rejected. For example, if the researcher's paper when printed will be 20 pages long and the journal publishes papers only up to 5 pages, his/her paper will be rejected not because of its scientific content but simply because his/her format did not match that of the journal.

3.1.5 Conditions of Submitting an Article

In some journals, one of the authors must be a member of the society that publishes the journal. Sometimes, certain types of statistical analysis must be used, or the experiments must have been repeated a number of times. Many journals have pagination charges that are exorbitant; you have to pay the journal to publish the paper. The charges are based on the number of pages that comprise the published paper. These charges can be extremely high. Some journals even expect money to be sent with the manuscript to cover the cost of considering the paper. Note, however, that some journals with page charges waive this fee for authors from certain countries. Look for these conditions in the journal's Instructions to authors. Researcher might have a series of photomicrographs or electron micrographs that are important to his/her paper. He/she should then look for a journal that prints such photographs well. Many journals do not print colour photographs, because they are expensive to reproduce. If his/her paper requires them, he/she will have to find a journal that will accept them, but note that many journals that print colour photographs charge the author for the colour.

3.1.6 Journal Style

Once you have decided on a journal to which you will submit your paper, you should start to prepare your manuscript in that journal's style and format. Most

journals publish a detailed guide to contributors, or Instructions to authors, usually in the first issue of the year but sometimes as a separate booklet. Write to the journal editor requesting these instructions or photocopy them from an issue in your local library. If a person other than yourself will type your paper, make sure that the typist also reads and follows the journal's instructions and specifications.

3.1.7 Review Article

A review article is a collection of findings and an extended version of the discussion in a research article. The article is divided into abstract, introduction, some sub – headings, conclusion, recommendations and references. An essential feature of a review is that the reader is led to the cutting edge of a given area of research. A good review article gathers together all important work on a topic, but it is not simply a catalogue of facts. It synthesizes work done, analyses and interprets existing facts and theories within a particular field.

3.1.8 Conference Paper

A paper delivered orally at a conference is prepared just like a journal article. It has all the characteristics of a journal article. It confines itself to a brief presentation of the objectives and the methods of the work and the results, the interpretation of which may be preliminary. Its clearly stated points can be brought out in the discussion. The paper may be criticized, corrections and observations made. Revised version of the oral presentation made for publication in the proceedings, can be more thorough.

3.1.9 Book Chapter

This is a contribution made by other writers if the text book is not single-handedly written by one author. Chapters of scientific works tend to synthesize information about a particular subject. A book chapter rarely sets out a fundamental hypothesis and objectives. A chapter in a text book with 1000 pages could be quite lengthy and this depends largely on the subject matter in which the chapter is talking about.

3.1.10 Annual Report

An annual report is a write up made to describe work completed in one year (12 months) period. The purpose is not to conclusively proof a hypothesis but rather to spell out objectives, describe activities and justify budget expenditure for a piece of research undertaken in the year.

3.1.11 Newsletter

The aim of an agricultural newsletter is to disseminate latest and hot information or innovation of interest to farmers and other stake holders quickly and in a readily digestible manner. Therefore, the content of most contributions carry little emphasis on justification or methodology. Technical writing usually starts by introducing the topic, then in a logical step-by-step approach, it presents research and leads to a conclusion. The sequence is exactly the reverse in a news story. A news story in a newspaper begins with the most important points, or the climax. This is called the lead. Then the facts are arranged in decreasing order of importance. The most important fact is at the beginning of the sentence, the most important sentence is at the beginning of the paragraph, and the most important paragraph is at the beginning of the story. News articles report timely events, ideas or situations of interest to farmers and readers of a particular publication. Most agricultural newsletters address a problem that affect generality of farmers, for example, disease outbreak, drought, crop failure, climate change, pastoral land shrinkage, conflict between livestock keepers and arable farmers, an epidemic, improvement methods, etc. There is always more news than space to report it. Thus, stories are shortened to fit the space available in the newspaper or magazine. Most news editors do not have time to read your article and rewrite it to fit the space. They 'cut from the bottom'. In other words, they will start chopping off paragraphs from the end of the story until it fits the space. This is why it is so important to put all the key facts in the beginning of the story. Agricultural newsletter should not be used as a substitute for publication of research results in referred journals or proceedings.

Features and articles which are longer and more literary than cryptic news stories are the most common format for science in popular publications. Most often, such articles are between 1000 and 5000 words long and editors expect the writer to keep to the number they request. Good and fascinating features capture and hold the reader's attention quickly, usually with the first two or three lines. This is called the hook or the caption and it often sketches a human story, perhaps, that of someone whose life has been changed by research results. It can also provide context for and, therefore, show the importance of the actual research. If the article is about research into how to manage tree fallows, it might relate some startling statistics about declining amounts of arable land around the world.

The body of the article contains the more detailed information on the actual research, when, where and why it was carried out, highlighting anything new or exciting in the way it was done. Even in the body, reference should be made to the ultimate purpose of the research, which will justify it to the public. The

conclusion of the article should tie together the story, much as it does in a scientific paper, but there is more room for human drama in a feature. Often, it is useful to return to the story used in the 'hook', showing how the research has changed someone's life, or helped solve a large problem. Writing good feature articles is not easy, it is a craft and art that takes time to perfect. However, it can be a great deal of fun and it allows the researcher to be more 'human' and 'personal' than is permitted in scientific papers. It provides an outlet for creativity that many researchers have, and the writing process will often help clarify, for the researcher and the reader, why the research is important. This is always useful, particularly when writing research proposals to solicit funding from government, non-governmental organizations and foreign communities.

3.1.12 Project Proposal

A project proposal is a summary of what a researcher intends to achieve at the end of the research work. Project proposal is just like a mini-research work that has not reached the stage of actual practice. It is always written in future tense and justifies a programme of work and states the expected outputs and clearly defines the objectives of the work. The write up will include an introduction, brief literature review, materials and methods. There will be no results and discussion because the work has not been conducted yet. If the proposal is to be sponsored by an organization or government, the breakdown of all the expenditure is paramount. The budget must be realistic, detailed, and accurate, listing personnel expenses, the materials required, their unit prices, supplies, travel, cost of the laboratory work and any other significant expenses. Do not include large amounts for contingencies or vague purposes. Also include a spending plan of when money will be needed through the life of the project. Cost each item carefully and allow for inflation. He/she may have to justify travel to meetings separately, outside of project travel. Different donors have well-defined priorities and specific requirements for their project applications.

3.1.13 Correspondence between Author(s) and Editor-in-Chief of a Journal

Any researcher who wants his/her work published in a reputable journal should carefully prepare his/her article in consonance with the below procedure or format. A full length article or short communication has to be sent to the journal company via e-mail or through post office, which ever method is available, even though the latter takes longer time to reach the editor in-chief than the former. The manuscript on receipt will be given a code number or article ID which the corresponding author will quote in all correspondences. In most cases, authors are asked to pay some amount as a review fee before their

article is reviewed. The manuscript takes two to four weeks to be reviewed by three different reviewers and the reviewers' comments or reports tell the writer whether the article is accepted for publication or rejected. Normally, if two out of three reviewers' comment state that the article is rich, informative, clearly written and could contribute to knowledge and, therefore, has met their criteria and fall within their scope, the paper will be accepted for publication as full length or short communication article with either major or minor review. The manuscript will then be sent back to the researcher as rejected or to effect the necessary corrections accompanied by a long provisional letter of acceptance indicating assessment of whole parts of the article, where to make necessary corrections. They will also send payment schedules of the pagination fee to be paid usually through the journal company's bank account or by bank draft in favour of the journal company. On fulfilling all conditions by the writer, a galley proof is sent to the correspondent author for proof reading and final corrections, if any. The publishers then publish the article on receipt of evidence of payment of pagination fee and a published copy will be sent to the author via e-mail as attachment in Pdf file or the reprint and some few copies of flyers will be mailed via post office to the correspondent author. Later, a copy of the journal issue in which the writer's article appears is mailed to the correspondent author through post.

3.1.14 Authorship of a Publication

This is a critical and confusing situation in the academic environment in Nigeria and elsewhere in the world where hard work and novelty is not respected. Authorship means, the person who holds the rights to the data, who did the research work and the researcher should be a person who has the mental capability to write and publish the work. If a researcher did some research in another country, perhaps, for MSc or PhD degree, he/she is entitled to use that material, but he/she should always get clearance from the supervising body of the university or institute in which he/she worked. If he/she intends to name other people as co-authors he/she must check with them to ensure that they have no objections.

It is very difficult to ascertain the true author of a published material since publication is considered as one of the most important criteria for accessing performance and qualification for staff promotions. A lot of authors plagiarize other people's work or copy materials from the pages of published books and articles claiming the ownership without acknowledging the real owners. In any case, the names of the author(s) should be complete enough to ensure proper identification; if there is any chance of confusion, use full names instead of initials. Include only people who are truly authors that have contributed

technically and financially to the success of the work and be listed in a logical order of importance. Note that, only people who have made meaningful contributions to planning and carrying out the research should be listed as authors. Anyone listed as an author should also have helped to draft the manuscripts or have revised important parts of it as collecting data is not enough to make a person an author, technicians and other research assistants are usually mentioned in the acknowledgements. Each co-author should give final approval to the version that is to be published. Unless names appear alphabetically, the first person listed is considered the senior author; others may be listed according to the importance of contribution to the work. Some researchers are too generous in enlisting friends, spouses, relatives and colleagues as authors for the benefit of promotions in places of their work, especially academicians, even when they have not contributed anything to the work. Researchers should not load up their articles with a long string of names. This is a bad habit in the field of research and technical report writing. It should be discouraged with impunity. It is wise to agree on authorship and individual input even before the study begins to avoid mist placed authorship of research publications.

Copyright is when People who write some documents, no matter the length, automatically possess certain rights to their work. This is based on the idea that whoever spends his/her time writing something, then if someone else uses it the author should be rewarded or acknowledged for that use. He/she wrote it, so he/she should be able to choose and control where and how it is published and used. This is known as copyright. Every researcher holds the copyright to his/her work. If a written document is to be published, the authors will usually transfer some or all of these rights, by formal agreement, to the publisher. Two of these rights are the right to make copies of the work and the right to distribute these copies. This is the international practice. Most journals will publish a copyright notice where they claim the copyright. This is made up of the copyright symbol, ©, sometimes, the word ‘copyright’, the year of publication, and the name of the copyright holder and the phrase ‘all rights reserved’ also appear on the inside cover of the publication.

If a researcher wants to include in his/her work a figure or a table or any other material from a published article or a book that is under copyright, the researcher must get a written permission from the copyright holder. The researcher writes to the publisher giving exact details of what he/she wants to reproduce and where he/she wants to print it. Most presses will grant all reasonable requests, at no charge, subject to the agreement of the author. At the same time, write to the author and ask for permission. When a researcher receives that written permission which is usually automatically, he/she sends

copies of both permissions with his/her article to his/her publisher or journal editor. The researcher should take his/her time to include in the legend of the copied item a full credit to the source, including author, publication, date, and publisher. A typical credit line in a figure legend would read as follows: Reproduced with permission from World Journal Agricultural Science, 2013, 2 (1): 121 – 125.

3.1.15 Conventional Publishing Ethics

This aspect will help a researcher to understand the fundamental ethics behind publication which conforms to the international recognized conventions surrounding copyright and intellectual property. Researchers should always keep in mind the way things are done and the strict code of conduct and ethics that exists in the field of publication.

Double publishing and multiple submissions are not allowed in publication of any kind. Double publishing is when the same body of data is used to produce two papers that are published in two different places. This is strictly forbidden and prohibited in article publishing circles. In addition, never submit the same article to several journals at the same time. Many international journals are becoming ruthless in their treatment of what they consider to be dishonest authors. Double publishing, and multiple submissions, are looked upon as cheating. Most journals make it a condition when they accept a paper for consideration that it is not being considered for publication anywhere else. Submit one article to one journal at a time. Never try to make two different articles out of the same block of data. The exception to this rule is writing for a general audience in a popular publication. After a research paper has been published in a journal, the author may then rewrite the material for a lay audience and publish it in the media. Not only is this ethical, it is to be encouraged. It is often only in this way that the public knows what researchers are doing. Even funding of project proposals can come about through popular write ups of research.

If an article has already been published in researcher's own language, the researcher should not expect to translate it, send it to an English-language journal and publish it there again. This may be seen as unethical and contravene the code of conduct of publishing companies. If a researcher intends to do this, he/she should tell the editor of the English-language journal what he/she has done when submitting the article.

If an article has already been published in another language, the researcher might still be able to translate and adapt the material for another journal, but it is

best to check with the journal first. Remember also that the researcher will probably need the original journal's permission to use the material in that way. If an article or a body of research has been published already as a preliminary communication or read at a major symposium or published in a proceeding, this should be pointed out to the editor. Publication like this may not mean that the paper is automatically rejected, but telling the editor is common courtesy and will protect the researcher from later disgrace and embarrassment. The researcher should also contact the conference organizers, if they hold the copyright to published proceedings.

3.1.16 General Format and Arrangement of the Journal Article

The general format and arrangement of the Journal Article write up should not be in chapters as in project writing. The entire work should be short but contain all necessary facts. Preferably, it should not exceed 20 pages for economic reasons during pagination. There should be consistency in the use of language. If British or American English version is used, it should be consistent throughout. The researcher should not be using British English in one place and American English in another place. Let there be a flow and logical arrangement of all the points for clarity and understanding of all readers.

The major sub- headings to use when preparing manuscripts are Title, Abstract, Introduction, Materials and Methods, Results, Discussion (or Results and Discussion), Conclusion, Recommendations, Acknowledgements (if any), References, Tables and Figures. Locally or internationally, manuscripts are usually typed on A4 size paper using double- spaced lining. Manuscripts should have, on page one, only the title of the article, name(s) and addresses of author(s), abstract and the key words. Then continue on page two with the Introduction, Materials and Methods etc. as the pages go on. In journal article writing, everything is the same as in Guide I except for key words which are not allowed in project writing. The Introduction and References may also differ from that of project writing depending on the journal.

(1) Key Words

Like the phrase implies, they are words usually written at the bottom of the abstract to give vital information to the reader about the work. Some journals instruct authors to state key words that are different from the ones used on the title and are not more than six words.

(2) Introduction

Introduction for this type of work is usually short and brief just as described

in Guide I but here, at the last paragraph; the problem statement and objectives of the study are indicated.

(3) References

References for journal articles are written based on the format and style adopted by the particular journal a writer wants to publish with. The list of references or literature cited is usually given at the end of the research paper or journal article. It normally begins on a fresh page in an alphabetical order of authors' surnames followed by initials (Harvard style). Others use numerical order. That is, the list of references is arranged numerically in order in which they are cited in the text of the article irrespective of the alphabetical sequence of authors' surnames. The items are numbered serially.

Chapter 4: Guide IV

4.1 References

References are the list of text books, journals, periodicals, conference proceedings and other published materials consulted for information. References list is written on the last page or before the appendix. In the text, references should be cited by the name of the author(s) followed by the year of publication in parenthesis and titles of their work. The letters a, b, c. etc., should be used to distinguish papers published by the same author(s) in a single year. Where there are more than two authors only the first author's name followed by *et al*. should be written e.g. "The availability of grains feed industry in Nigeria (Obioha, 1975) or Obioha (1975) observed that the availability of grains feed industry in Nigeria……. "For two authors e.g., "The ingestion of numerous dietary components has measurable effects on blood constituents (Church and Thomson, 1984) or Church and Thomson (1984), observed that numerous dietary components have measurable effects on blood constituents". For three or more authors e.g., "The characteristics of repeat breeders in cattle (Kubkomawa *et al*., 2010) or Kubkomawa *et al*. (2010) reported the characteristics of repeat breeders in cattle in four local government areas of Adamawa state, Nigeria". While in the list, references should be arranged alphabetically, they should include the entire author's names (surname precedes initials), year of publication (in parenthesis), title of the article, name of publishers or journal (accepted abbreviations may be used), Volume number, issue number in bracket or use column and page numbers last.

References are written in single line spacing but for space between one reference and the next it is double line spacing. The following format could be adopted:

4.1.1 Text Books

Names and initials of all authors; year of publication, full title and sub-title in italics or underline, edition number if any, chapter or page numbers, names of all the editors, names of the publishers, city and country. For example:

Steel, R. G. D. and Torrie, J. H. (1980). *Principles and Procedures of Statistics*: *A Biometrical Approach*, 2nd ed., McGraw Hill Book Co., New York, USA.

4.1.2 Chapters in Text Books

Bratzler, I. J. (1971). Palatability Factors and Evaluations In : The Science of

Meat and Meat Products. 2nd Ed., J. F. Price and B. S. Schoseighert (Ed.). W. H. Freeman and Co., San Francisco, USA, Pp. 14-35.

4.1.3 Journals

The names and initials of all authors, the year of publication, the full title of the article, the title of the journal (sometimes abbreviated) in italics, the volume number, issue number as well as the first and last page numbers. For example:

Alaku, S. O. and Morupa, S. M. (1988). Organ Weight Losses in Goats during the Dry Season in the Sahel Region of West Africa. *Journal of Arid Agriculture*, 1 (1): 23 - 35.

4.1.4 Symposia and Conference Proceedings

Names and initials of all authors, year of publication, title of chapter, title of conference or symposium. Name of place where the conference was held, range of page numbers, names of all the editors, names of the publisher and city and country. For example: Rastogi, R. K. (1989). Rabbit Production In: The Caribbean with Special Reference to Trinidad (West Indies). In: Livestock Production and Diseases in the Tropics. Kuil, H., Paling, P. W. And Huhn, J. E. (Eds). Proceedings of the 6th International Conference of Institutes of Tropical Veterinary Medicine. 28th August to 1st September, 1989. Wageningen, the Netherlands, Pp. 252-255.

4.1.5 Articles from Magazines. e.g.

Alubo, O. (2010, March). The Beijing challenge *News watch*, 51 (13): 5 – 10.

4.1.6 News Papers. e.g.

Bala, D. (2010, March 1). The Army Again? The Guardian, Lagos, 27 (11): 63 - 69.

4.1.7 Internet or On-Line References. e.g.

Journals with Digital Object Identifier i. e. Unique Code Given to an Article by the Publisher. For example, Lale, N. E. S. and Igwebuike, J. U. (2002). Field Infestation of faiherbia (Acacia albida Del.) A. Chew Pods by Stored Product Coleoptera in the Nigerian Savanna and Effect of Infestation on Nutrient Quality. Journal of Arid Environments, 51:103 - 112.

Journal without Digital Object Identifier (DOI) - Use Web Address E.g.

Ogunyemi, B. (2005). Mainstreaming Sustainable Development into African School Curricula: Issues for Nigeria. Current Issues in Comparative Education, 7 (2). www.tc.edu/cice, Retrieved on 26th February, 2010.

Online Materials with no Identified Author and No Year. E.g. Development and underdevelopment (n.d.), retrieved from: http:/www.Anc.Org.za/ancdocs/pubs/umrabulo/umrabulo/23/development.htm on 28th February, 2010.

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