

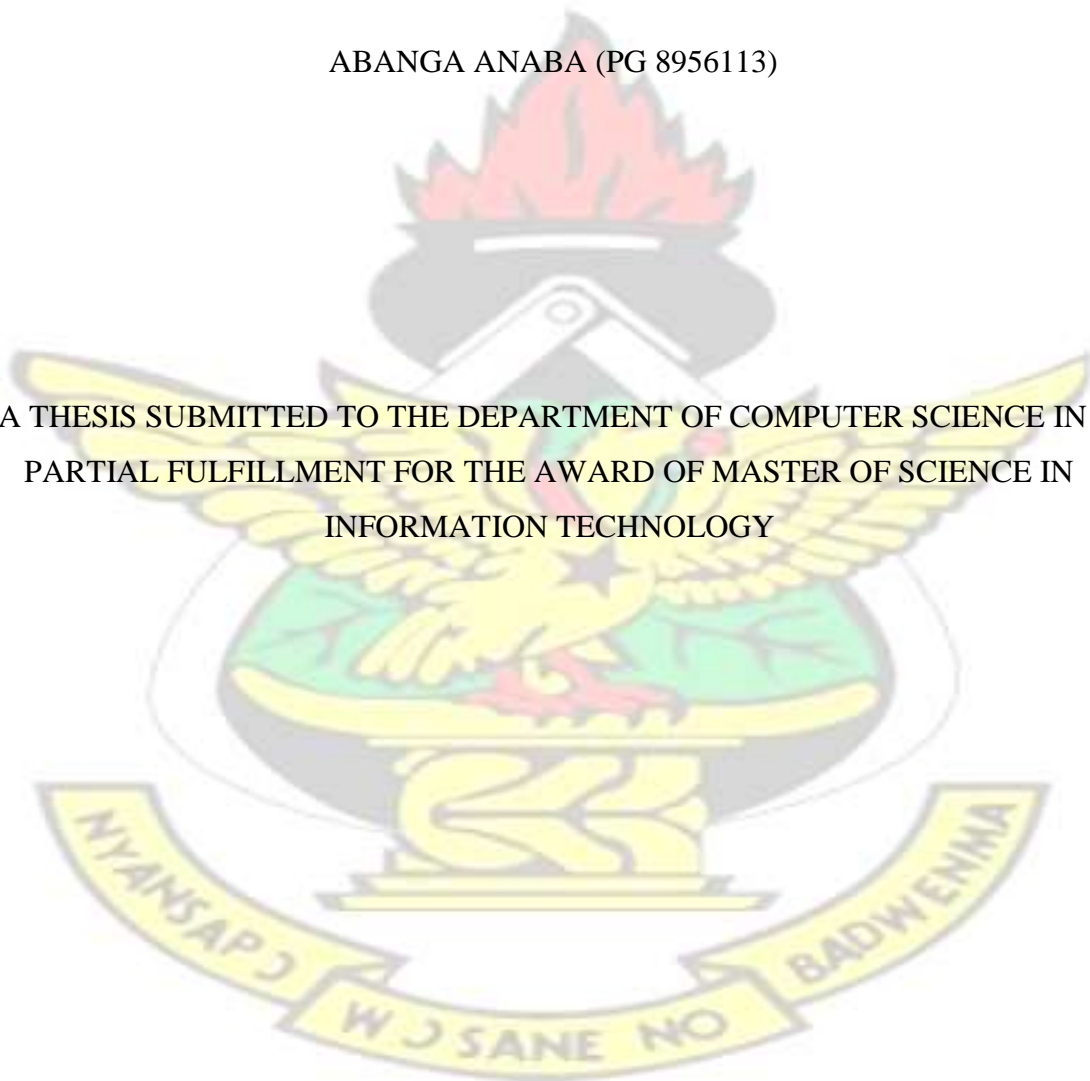
IMPROVING ACCESS TO AGRICULTURAL DATA USING AN INTEGRATED  
DATA MANAGEMENT APPROACH

CASE STUDY: GHANA AGRICULTURAL PRODUCTION SURVEY

KNUST  
BY

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INFORMATION TECHNOLOGY



JUNE 2018

# KNUST



## DECLARATION

I hereby declare that the submission of this compilation is the true findings of my own research work submitted towards an award of Master of Science in Information Technology and that, to the best of my understanding, it contains no information already published by another person nor submitted to any other University or institution for the award of degree except where proper acknowledgement has been made in text.

However, references from the work of others have been clearly stated.

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## ABSTRACT

Agricultural development is vital to achieving the Millennium Development Goals, particularly those related to poverty and food security and to environmental sustainability. Promoting agriculture data access is a way of fulfilling an important need of the national economy of a country. Ensuring that stakeholders have access to quality agriculture data is important in promoting development and also a step towards achieving sustainable development. Many developing countries across the globe do not have easy access to quality agricultural data. In Ghana deficiency in capacity, inadequate infrastructure and community support for agriculture data collection has been reported. The main objective of the study was to assess the usefulness of the Ghana Agriculture Production Survey in providing the needed data for stakeholders of agriculture. The study used a descriptive survey design. Respondents were selected from eighteen (18) districts across Ghana using stratification based on geographical location of the districts and simple random sampling technique. In all one hundred and four (n=104) respondents were interviewed using one structured questionnaire. The data were analyzed using Statistical Product for Service Solution (SPSS) Version 24 for windows. The results were quantitatively presented using tables and charts in the form of frequencies and percentages. The study results reveals that a majority of the respondents showed high perception and good satisfaction regarding the system. However, some respondents were of the view that standards and governance procedures were not fully adhered to, despite the fact that they observed improved effectiveness and efficiency in the system. Insufficient time and inadequate logistics were also some of the challenges identified as well as inadequate financial resources, community sensitization and public education as beyond system level challenges. Therefore, it is suggested that management should implement the appropriate strategies to address the identified challenges with use of institutional and stakeholder collaboration. Since improvement in utilization and quality of any system require a multi-sectorial teamwork. Addressing these challenges can lead to the sustainability of the good things that exist and further improvement of the system. Hence this study provides valuable information for improving agricultural data access in Ghana.

## ACKNOWLEDGEMENT

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I also thank all the lecturers in the Department of Computer Science for their encouragement and guidance during the Master’s Program.

My gratitude also extends to all the sampled staff for agreeing to be my respondents for this study. I say God bless you.



## DEDICATION

I dedicated this work in memory of my late father Adure Abanga and my late mother Akologo Ayaaba. May their souls rest in perfect peace Amen!!

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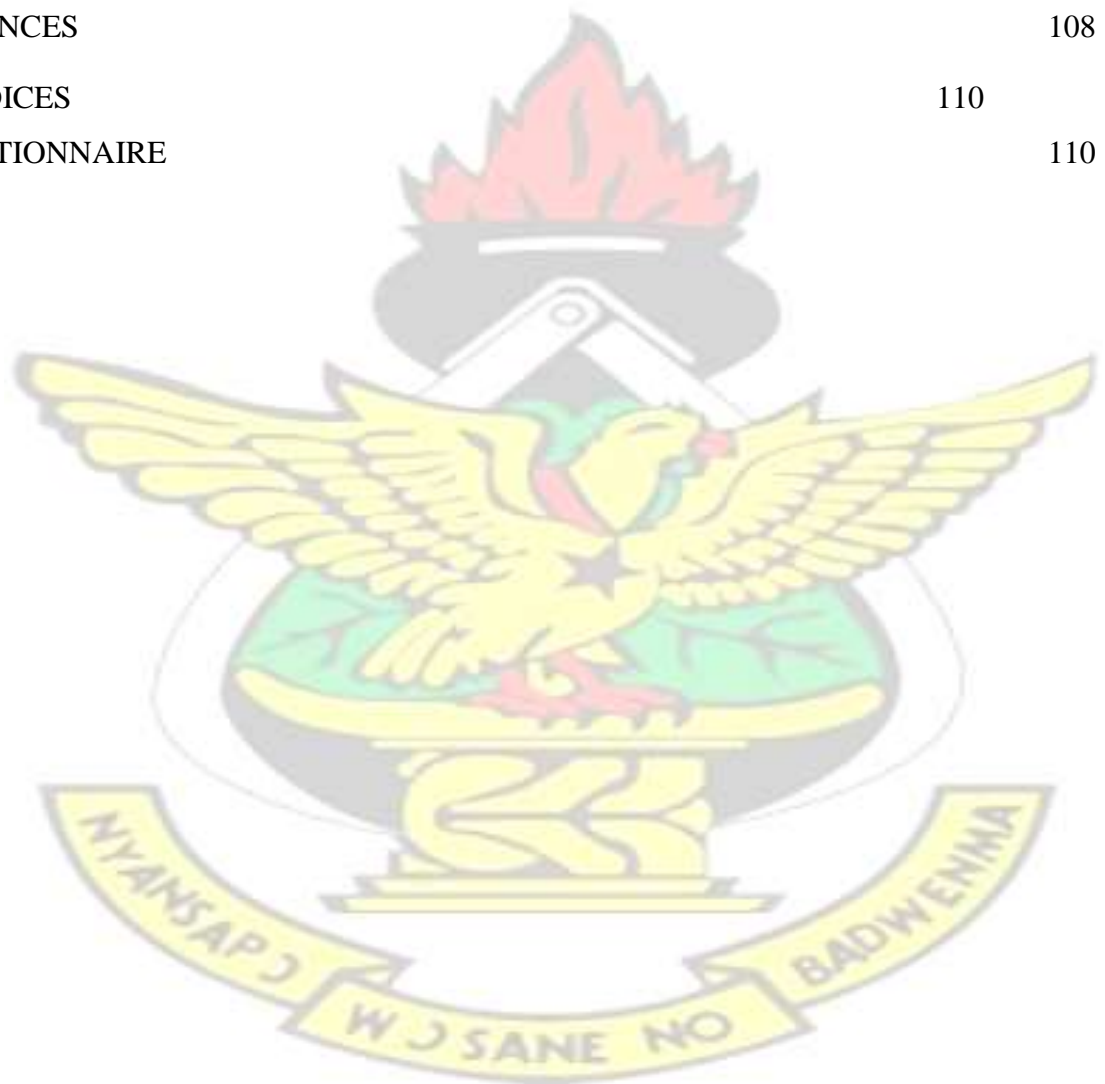
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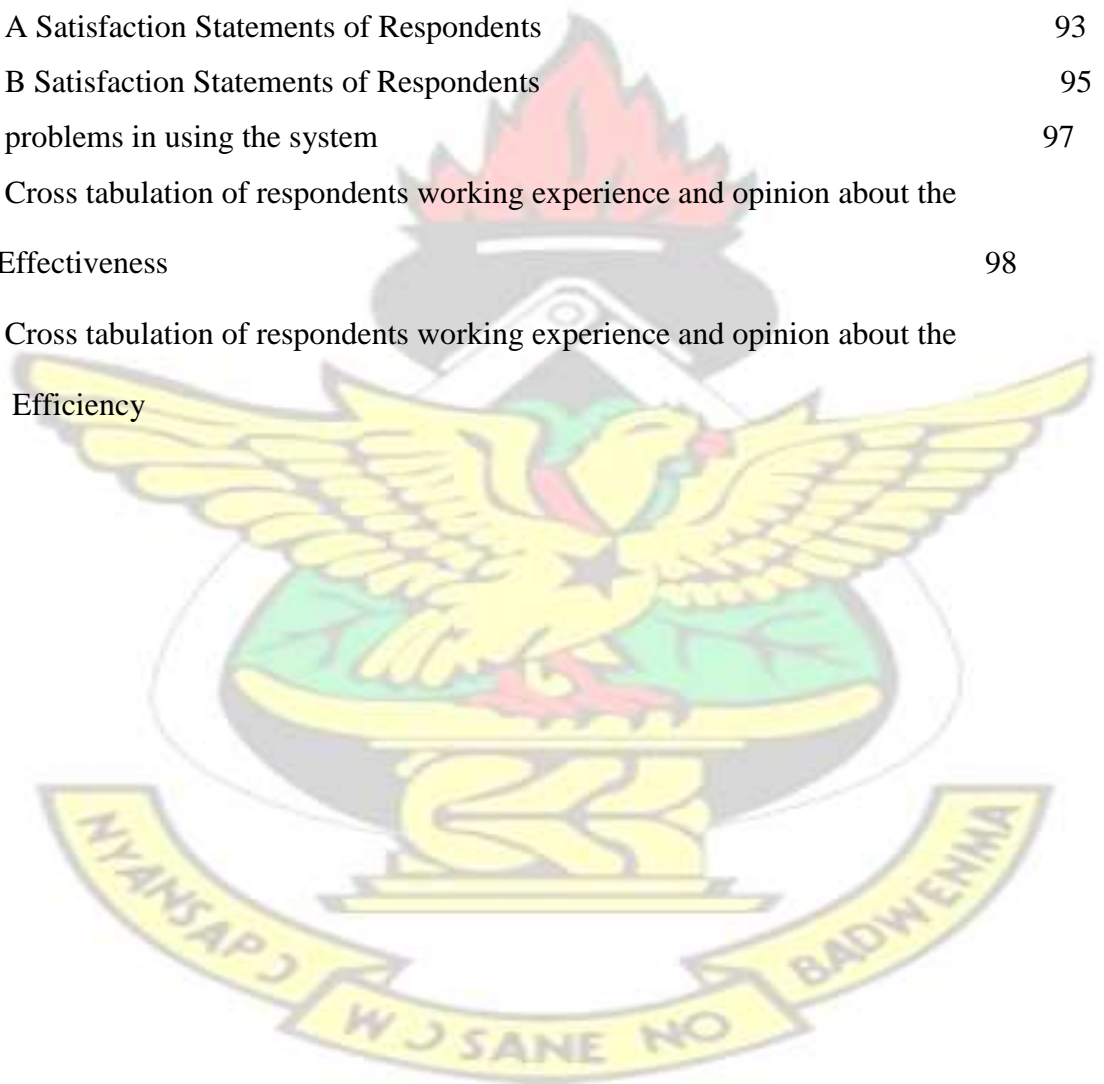
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# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1 Background**

Ghana's Agriculture is mostly practiced as a family operation or business, dominated by small holder farmers with the use of simple equipment to produce about Eighty percent of the country's total Agriculture output. By estimation, about 2.7 million Ghanaian households rare some livestock or own a farm. From the recent population and Housing census, about 50 percent (Ghana Statistical Service 2013) of the labor force or 4.2 million Ghanaians are involve in agriculture. Most of the farms holdings work on less than two hectares of farms land, with majority of the few large scale and plantation producing mainly Cocoa, Oil palm, Rubber and Coconut and to a lesser extent Pineapples and Cereals like Maize, Rice, Sorghum. Ghana's Agriculture production is mostly dependent on rain. However an estimated 6,000 farmers, country wide uses some form of irrigation (Food and Agriculture sector development Plan (FASDEP II) (2007) Ministry of Food and Agriculture, Ghana)

### **1.2 Existing Agricultural statistics systems in Ghana**

The most important agriculture statistics systems carried out by Ghana Ministry of Food and Agriculture (MOFA) and Ghana Statistical Services (GSS) are Agricultural Sample Census (ASC) and The Multi –Round Annual Crop and Livestock Survey (MRACLS)

The Agriculture sample Census undertaken by Ghana Statistical Services (GSS),this is planned along with the National population and Housing Census every decade(10 years), but the recent one was in 1984, more than century ago.

The Multi-Round Annual Crop and Livestock Survey (MRACLS), undertaken by MOFA, Agricultural data collection is carried out yearly at the lowest level of administration (districts).The survey intention is to collect agricultural data from a sample of Agricultural households, institutional and commercial farms in all districts in relation to inputs, farming practices, infrastructure, assets, sales, labor utilization, livestock, and poultry, measurements of fields and yield estimates. Unfortunately, the relevant parts of the survey (MRACLS), has not been carried out of recent, as such, the survey only produce data for farmers field area measurements and estimated yield. The

issue is that the MRACLS presently does not provide the detailed information of farmers about farming dynamics, farm inputs, use of labor, infrastructure, household assets, sales, as well as poultry and livestock and a vast of other information including commercial and institutional farms as its original intention. Also, the survey authority does not release the data in the raw form but only makes the aggregate data available through Statistics Research and Information Directorate (SRID) (Estaben J, Juan M. and Guysian N. (2011) A strategy for Agricultural Statistics in Ghana Working paper Number 025)

Even though the data is collected in the raw form, it is only collated for MOFA's needs, after which it is made available to other users. As such, it is made not useful in addressing most users, monitoring, evaluation, analysis, policy and planning needs and also hinders data quality assessment. This result to MRACLS currently providing inadequate statistics, a sample unrepresentative for making any meaningful decision.

Furthermore, an evaluation of MRACLS and ACS shows that they have several things in common on both the plan of the procedures and instruments used on the field (not considering measurement of time and regularity). This propose that not until the ACS was completely supported and managed well, it too would be beset by similar institutional encounters that have challenged the MRACLS. Therefore, it is crucial that similar institutional challenges restricting the MRACLS and ASC be dealt with to safeguard the realization of potential agricultural statistics systems. (Estaben J, Juan M. and Guysian N. (2011) A strategy for Agricultural Statistics in Ghana. Working paper Number 025).

Additionally, it must be shown that a similar way in which the survey instrument has been planned to produce data dealing with related issues proposes that one wellsupported, designed, and executed Agricultural survey would be enough to provide the requirements for national and local policy makers, planners, and researchers if it were to be carried out on annual bases. On the contrary, if the MRACLS were working as planned, there wouldn't have been the desire for a decennial ACS since Ghana would already, in effect have a yearly sample census of Agriculture. (Estaben J, Juan M. and Guysian N. (2011) A strategy for Agricultural Statistics in Ghana, Working paper Number 025)

As a result of these challenges, the Ghana Agriculture Survey (GAPS), a pilot survey project which took place in 20 districts from 2011/ 2012 aims at improving the quality of data being produced by the national agriculture statistics system. The GAPS will meet this objective by widening and expanding the Multi-Round Annual Crop and Livestock Surveys (MRACLS) that the country's Ministry of Food and Agriculture uses to assess data from its District Agriculture Development units (DADUs). MRACLS presently involves agriculture production, giving estimates of field area and yields of important crops, among other areas. GAPS suggest a possibility trial with future enhancements to MRACLS before they are up-scaled nationwide. GAPS is being headed by the Statistics, Research and Information Directorate (SRID) of the Ministry of Food Agriculture (MOFA) with the technical support from the Ghana Strategy Support Program (GSSP) of the International food Policy Research Institute (IFPRI). The potential enhancements GAPS tries include:

Increased sample size and widen the sample designs to increase the consistencies of the district-level estimates.

Broader coverage and greater penetration of data. This calls for the generation of an instrument or a questionnaire that consider Agriculture production undertakings: not excluding livestock rearing, tree crops, vegetables, aquaculture and Agro-processing in more detailed. Also, data collection will include the minor season on important activities such as irrigation, other farm and nonfarm income generating activities and movements like migration.

Advanced tools and intensified procedures, Global Position Systems(GPS) devices that speeds the processes of field area measurements and enables field officers to reference geographically location of household and their farms.

A standardized data capture in all districts, prompt computer aided data check to help improve computer-based and personnel centered supervision and quick transfer of the raw data to a central processing location will guarantee the quality of the data being generated.( Estaben J, Juan M. and Guysian N. (2011) A strategy for Agricultural Statistics in Ghana. Ghana strategy support program (GSSP), Working paper Number 025)

### 1.3 Statement of the Problem

Agriculture contributes to development, as a source of livelihoods, and a provider of environmental services. Many countries, especially in the developing world, lack the capacity to produce and report even the minimum set of agricultural data necessary to monitor national trends or inform the international development debate. Agricultural development is vital to achieving the Millennium Development Goals, particularly those related to poverty and food security and to environmental sustainability.

In response to the many challenges of meeting the user needs for agricultural statistics, a Global Strategy for Improving Agricultural Statistics was produced (by FAO in close collaboration with the World Bank, Regional Development Banks and the Regional Commissions of the United Nations) and endorsed in February 2010 by the United Nations Statistical Commission.

The Food and Agriculture Organization outlined the need for complete re-assessment of the statistics requirements for the latest era including the best way to collect such data. It also talked of the magnitude as well as quantum of statistics emerging through state official site is being rapidly reducing as at the beginning of the 1980s, especially through Africa countries. From the assessment also, there is rising needs for up-date statistics to collaborate agriculture data in order to appreciate the effects caused by them on nature with changes in climate and also to manage well with policies matters (FAO, 2011)

In this respect, the Statistics, Research and Information Directorate of Ghana Ministry of Food and Agriculture in carrying out its mandate of Agriculture data collection and surveys to generate data to help the formulation of policies and it's implementations over the past years has been using a system called the Multi-Round Annual Crops and Livestock Survey (MRACLS). The MRACLS data generates information on Agriculture production by providing estimates of field area and yield of major crops grown in Ghana. But this attempt nonetheless exclude the provision of complete information on farmers like, inputs use, agriculture infrastructure, and farm practices. Hence the search of linking agriculture data demand, quality and its availability.

(ebrary.ifpri.org)

The Ghana Agriculture Production Survey (GAPS was therefore initiated to enhanced the procedures used for data generation to improve the quality of Agriculture statistics

collection and accessibility. Therefore, GAPS originates as a trial with updated sample strategy, increased coverage of questions more than that of the MRACLS and inclusion of geo-referencing. The motive being that the survey (GAPS) is seen to produce consistent and reliable data on agricultural production in Ghana which need not depend solely on extensive memory of the farmers. (ebrary.ifpri.org)

However, for GAPS to be upscale to embrace the entire country following two years of trial of the survey, there exist the necessity to evaluate how suitable the system (GAPS) is in providing data for agriculture policies and planning for development at the local government level (districts), regional and national levels and what are its challenges if any. (ebrary.ifpri.org)

#### **1.4 The Objectives of the Research**

The main objective was to assess the survey (GAPS) in providing the needed data for stakeholders of Agriculture Specific objectives:

To examine perception and satisfaction of respondents on the usefulness of the system

To identify the challenges if any

To explore measures of improving accessibility and quality of Agricultural data.

#### **1.5 Research Questions**

To address the issue of how Agriculture access can be improve, the study focused on the following research questions

1 What is the perception and satisfaction of respondents about the integrated data management system?

2 What challenges do respondents face in using the integrated data management system?

#### **1.6 Significance of the Study**

Undertaking this process would enable Ministry of Food and Agriculture.

To extremely improve agricultural statistics systems in Ghana

To significantly enhance the tools, procedures of the system

It would also make it viable for MOFA to choose the right way forward, which may include scaling up GAPS nationally

Policy makers and researchers in Ghana would have the access to agriculture data which is of high quality and on an annual basis.

### **1.7 The Study Scope**

The study scope includes:

An extensive understanding of the factors that hinders the access of agriculture data in Ghana.

A conceptual model describing agriculture data management, its stages and how it works.

Come out with recommendations, how agriculture data can be regarded as an integral part of an organization resource management.

Recommendations for protective measures of agriculture data resources

### **1.8 The Study Limitations**

Restrictive weakness in the data collection may affect the study: The researcher used only one instrument. If other Instruments such as the interview schedule and focus group discussion had been used, the quality of the study could have been improved upon. In addition, the sample used for the study is limited hence, the findings of the research are tentative and cannot be generalized.

### **1.9 The Organization of the Documentation**

The documentation is made up of five chapters.

The first chapter will be made up of the introduction to study process which discusses the background to the study, the statement of the problem, the scope, the study objective and the significance of the study, as well as the limitations of the study. The next chapter, thus chapter two looks at the literature on the subject, this will review the existing literature as regards to the topic with the view to providing a context for the

rest of the work. In chapter three, the methodology to be used in this study will be thoroughly explained and the data adequately described. The fourth chapter is where Analysis of data will be done and the results explained, Conclusions will be drawn in chapter five and recommendations made.

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## CHAPTER TWO

## LITERATURE REVIEW

### 2.0 Introduction

The review stresses on theoretical review and empirical review of data management. The theoretical review discusses the concepts: Data Management, Integrated Data Management, and Data Management Pitfalls. While the empirical review consists of many recent works on Agriculture data managements systems

### 2.1 Data Management Overview

The formal description offered by expert organization for those concern with the management of data is: "Data Resource Management is the development and execution of architectures, policies, practices and procedures that properly manage the full data lifecycle needs of an enterprise." This explanation is fairly wide and embodies different carries that may not have straight and practical connection with lower-level attributes of data management, such as interactive database management, (Central.gutenberg.org).

In another way, the meaning given in the Data Management Body of Knowledge (DMBOK) is: Data Management is the creation implementation and control of procedures, strategies, decision, policies, and attempts that manage, guard, provide and enrich the worth of data and information resources. The idea of Managing Data ascended since the 1980s when technology changed from sequential handling (first cards, then tape) to random access handling. Once it was now practically feasible to store a single element of information in a specific location and retrieve that with the use of random disks, those advocating that Data Management was more essential than Process Management which used arguments such as a purchaser's residence location is saved in our computer system. Through this stage, random access processing was not competitively of high speed, so those proposing Process Management was more viable than Data Management which batch processing time as their primary argument. For redeployment into more real-time collaborating applications, it became clear to a greater number of experts that the two management processes were crucial. If the data was not properly explain, the data would be distorted in applications. If the process too were not appropriately described it will not be possible to meet user's satisfaction.

The management of data life cycle known as Data life cycle management (DLM) is a policy –focus procedure to managing the movement of an information scheme data all over its life time: from design, to the first capture, to a state when it appears outdated and is removed. Numerous vendors’ deals with DLM products, however, real data management includes proper thought-out plans and observance of standards and usage. There are different methods to data management. Master data management for instance is a broad or all-inclusive approach allowing an organization to connect all its important data to a location, or one file called the master file that offer a common place of location, (Central.gutenberg.org).

The need for proper management of organizational data increase in vitality as organization are confronted with rising number of fulfillment and of protocol and guidelines. Moreover, the complete quantum of data that need to be managed by organization has augmented significantly, that it is some time term as big data. The management of big data involves the organization, administration and control of both organized and unorganized or formless data. Government organization, Corporation and other organizations use big data management approaches to assist them cope with rapidly increasing volumes of data, mostly containing many terabytes or more information and a collection of data types (Central.gutenberg.org).

In current management practice, it is simple to recognize movement away from the word data in combined terms to the expression information or generally knowledge when speaking in non-technical settings. Hence there is not only data management but also information management and knowledge management. This is an ambiguous movement because it conceals that convectional data are handle or someway treated as a second thought. The difference between data and the resulting importance can be observed in the information hierarchy. Though data can be as such, knowledge and information are always in the “eye” (the mine) of the viewer and can only be considered in comparative terms, (Central.gutenberg.org).

## **2.2 Data Management Integration**

The term integrated data management (IDM) is a management strategy that ease the management of data and enhanced accomplishment .IDM involves an incorporated, settings to handle organization’s application information and improve data- focused

usage over its duration. IDM's aim is to generate organization prepared application faster to increase data access, fast iterative testing and strengthen association between designers, planners and Database Administrators (DBAs), (fr.slideshare.net).

Real data incorporation or database integration means the power to retrieve any form of data within or external to the organization and this information in generally any application or system. Data may be captured in an interactive or non- interactive order such as Oracle, DB2, SQLServer, MySQL, and Essbase. Access to the information is normally in the form of dashboard, query and reporting format, it can also contain modification facilities, and can occur in bulk, real-time or near real-time. Currently, data management groups need broader collection of management tools to match with faster moving data environment. With vast data emerging from more than varied locations, it is important that data management experts have the correct tools at all times. Software vendors have seen the need and have widely increase their own complement of data integration tools, and numerous new companies giving unique tactics to fast track or power down-and-dirty data management missions, (fr.slideshare.net).

As an example, open source data integration vendor called Talend begun in 2005 by offering extracts, transform and load(ETL) operation but as then grown to give data profiling, data quality, data cleaning, master data management, data harmonization and web services usage integration ,(fr.slideshare.net).

Other data integration vendor's emphasis on technology roles. Data watch Corporation for instance are experts in extracting data from form legacy uses, precisely mainframe green bar reports, working reports, PDF documents, and invoices and other documents and converting them into collaborative web-based reports or Excel documents, (fr.slideshare.net).

Another vendor, AttunityLtd, has seen been recognized for its connectors to mainframe legacy applications but of late, the fastest moving part of its business involves offering change data capture (CDC) and replication services. As the speed of business expands, organization need data delivered faster. CDC captures change from system log files and feed them to extract, transform and load (ETL) messaging buses or file transfer protocols folders where they can be loaded into a data warehouse or target system. CDC is an important technology to ease near-real-time data delivery. (fr.slideshare.net).

Reproduction has conventionally been considered to produce duplicates of data for security reasons but is currently gradually used to help active- active designs and multipurpose data silos, one for top-down documentation and another for bottom-up or informal analytics. (fr.slideshare.net).

The virtualization of data (or data confederation) has of late turn a critical component in data assimilation portfolio. Instead of using the resources available in building a data warehouse or data store, data designers use data virtualization devices to help operators retrieve and link data on the fly from wherever it is sits, (fr.slideshare.net).

### **2.3 The Pitfalls of Data Management**

Several data supremacy ideas do not succeed for various reasons. Below are some drawbacks usually talked about by data governance experts.

Not able to implement. The major output of a data governance agenda is strategies and plans for the classification and management of information. However, not until the plans and processes implemented and procedures respected, all discussions and arrangements would be for nothing. An alternative to implementing a data governance system is to have support and understanding of the organization's audits and compliance group who are assumed to have previously implemented other organizational strategies and programs, (fr.slideshare.net).

“You don't want to be a toothless tiger,” Stiffer stated. “If you don't enforce data policies, organizations will quickly backslide.” Intensified John Ladley, Head if IMCus Solutions, a data management consultancy and author of Making Enterprise Information Management Work for Business (Morgan Kaufmann, 2010) “If no one has ever gotten fired for violating a data policy, you probably aren't enforcing it.”

Similarly, it is necessary to accompany words with encounter. The data governance agenda devised a data management group in the Information Technology unit to put in place procedures outlined by the data governance board, (fr.slideshare.net).

The people managing data consist of different members of the IT group who handle data, with application developer, data analyst, data administrators, and project managers. These people guarantee that all procedures concerning data are followed and the adoption of the different tools to power data management activities. The absence

of an effective collaboration linking IT and Business, leads data governance schemes to run to a stop. A signal of sound and effective relationship is that organization fully support data management activities, duties and tasks, (fr.slideshare.net).

A good signal that a data governance system will not work is when the boss or the chief executive officer (CEO) appoints the head of IT to manage the program. This shows that the organization sees data as a technical activity and not business endeavor. Meanwhile, it is right for IT to start the discussion about data governance and tells its significance to the organization. IT should formulate a business case and attempt to secure support of topmost ranks. Preferably still, IT can recruit a strong business executive who has influence among business executives to sell the program. “It doesn’t matter who comes up with the idea; the key is to get buy-in from different organizations,” Stiffler said, (fr.slideshare.net).

Any data governance system should expect criticisms. Taking data from the hands of people and sections and turning it an organization assets will definitely intimidate and irritate most of the end users specifically middle level managers whose authority normally comes from managing the movement of data within the organization. “Resistance is normal,” Ladley said, (fr.slideshare.net).

Managing change has to be included in any data governance or management program. Mostly, this includes the identification of who is going to be affected by the new policy and creating education, communication and motivation strategies to get those people to accept the new actions. It is a wise idea to take advice from other parts of the organization to assist generate a well-defined plan that places and define the final beneficiary’s communities and develop a messaging strategy towards each of them. The plan need to explain which information get transferred to which community through what means at what instance, (fr.slideshare.net).

#### **2.4.1 Improving Agricultural Statistics in the Global Strategy**

Several nations particularly those in the stage of developing, do not have the needed strength for generating or just to document the least set of agriculture statistics required for the observation of the country movements or tell the world wide growth deliberation. The Food and Agriculture Organization outlined the need for complete reassessment of the statistics requirements for the latest era including the best way to collect such data. It also talked of the magnitude as well as worth of statistics emerging through state official site is being rapidly decreasing as at the beginning of the 1980s, especially through Africa countries, (Open knowledge worldbank.org). Again, it discovered that information officially transmitted by African countries are at the lowermost state ever since before 1961 with a quarter of Africa countries documenting basic data on crop production. From the assessment also, there is rising needs for update statistics to collaborate agriculture data, forestry, as well as fisheries in order to appreciate the effects caused by them on nature with changes in climate and also on the use of bio-fuels to manage well with policies matters.

#### **2.4.2 Contributing Factors to the Decline**

Several probable reasons account for the decrease in the volume and quality of statistics relating to agriculture and rural growth. The absences of a national capacity at the public statistical organization is a clear reason, (Open knowledge worldbank.org).

Assessing the Food and Agriculture Organization in 2008 indicates the major urgent need in a country statistical strategy being enhancing the capabilities on statistics for agriculture, which the assessment defined as a “re-emerging” want. Falling in urgency and in the means that national agriculture systems, a lot to the collection and documenting quality statistics on agriculture is hampered through a complete absence in attraction by donors. The necessity in counting these issues as agriculture production effects on the environment as well as the production effects on bio-fuels, food requires creating fresh theoretical structures that are different from the conventional fields of agricultural statistics.

Apart from the absence of strength is the absence of adequate financial resource for the collection of data.

Another problem is that agriculture statistics are normally not within the country system of statistics, with ministry of agriculture and other organizations in charge like forestry, fisheries water use, land and the inability to match up with rising data needs. In most nations, the inability to integrate into a system of national statistics is a good cause for the decline of statistics on agriculture. Where the system of statistics are decentralized, integration of the official national statistics with the ministry of agriculture are normally not in existence, or does most countries policies for statistics development fully include the agriculture sector. The partnership in statistics for Development in the 21<sup>st</sup> Century (PARIS21) latest evaluation discovered that, from a total of 78 International Development Association (IDA) nations, only 43 (55 %) has a country plan for the enhancement of statistics with agriculture inclusive. With these countries, 43 IDA nations, just 4 to 10 nations (that is only about 10% of all IDA nations world-wide) more or less embraced agriculture appropriately in their country's programs for development of statistics.

The global strategy prepares a plan for a harmonized and future initiatives to tackle the fall in agriculture statistics systems. Many attempts concerning the objective of increasing agriculture statistics gives an important contribution to the development of the global strategy.

The strategy is also centered on a wide discussions with national statistics centers, the agriculture ministries, and several local organizations and all international organizations which shows concerns in Agriculture statistics improvement. All the steps in the development of statistics among nations are considered with the practical enhancement applicable to the development of statistics.

However, the strategy can be seen as future plan involving the assessment of national level governance, statistical capacity building creation among the national statistical systems, also resources reinstatement to take it ahead. The following are what the global strategy keeps on with.

Comprehensive theoretical structure centered on a detailed review of stakeholder data requirements were established. It is directed to several resurfacing needs from matters directly connected to agriculture like hunger and poverty, water and land use, climatic change including the environment and rising food use with feed commodities to produce bio-fuel. The structure proposes the global strategy to be centered on three

pillars:-The minimum set of core data identification, agriculture integration into the national statistical system, and agriculture statistics system sustainability by building of statistical capacity as well as statistical governance.

### **2.4.3 Pillar One, Recognizing the Least Set of Core Items and National Priorities**

#### **Establishment**

This section describe the minimum set of world-wide comparable basic data that all nations should produce. The data needs are given as a list of indicators. This list comprises of those that are related to agriculture and rural growth and also other sectors or subsectors like livestock crops, climatic change indicators, land environment and rural economics. This list indicates technical records, source of data and data needs to produce the indicators. The choice of these basic data is essential because the volume of data that is needed to satisfy all demand is more than what many developing nations can presently produce, Not till the capacity of their systems is considerably improved. A structure is given to all nations in addition to this set of core data, and other things to find the data production rate and needed scope of national coverage. Executing the global strategy will start with using this core and national items and its related data.

The indicators shows that basic information concerning livestock, crop production counts, fish capture, aquaculture, including timber removal from the forest are main information sources. The world program of Agriculture Census by the Food and Agriculture Organization (FAO 2005) mention 149 crops types, 28 species of livestock and over 1000 aquaculture species. Not every country has all these things, they are also not of equal importance where ever they are found. Production data, inputs and prices for all these many hundreds items are required for indicators like the growth of the Gross Domestic Product (GDP) from value added from agriculture with several others. The Food and Agriculture Organization of the United Nations distribute survey instruments (questionnaires) to countries annually asking for trade, land use, production, agriculture machinery and equipment fertilizer and pesticides usage data, Information producer prices are also called for. The encompassing of the annual demands on the population shown above is an issue, (Open knowledge worldbank.org).

Such statistics needs is more than what a country can provide annually. As a result, the initial point is to choose the lest subset which nations can produce applying normal

descriptions including approaches for the purpose of confirming initial measurements are similar. Finding core subset of data items that would be produced annually and the frequency that other statistics is to be provided are the aims, (Open knowledge worldbank.org).

The section next outline the procedures to building a globally unit data that every nation has to produce. Since nation's holds different and inadequate capacities, it is wise that all countries form precedence based on the additional items to local statistics plan including the core items. The importance of the global agriculture production is the bases for choosing the core data. As an example, just around 10 crops types and 4 species of livestock contributes to more than 95 percent of the global cereal production, meat and fiber. The main items are those that data goes through several of indicators required observing and assessing policies on development, issues on food security with growth directed to achieving the Millennium Developments Goals (MDG). Core data must be feed onto the country stock and world balance of demand with supply of food with other products of agriculture. The proportion of land use accounted for by crops core data must be bigger, meaningfully support to the well-being of farm and rural households, it should also have an impact on the climate and the environment. The items should be the first to be added in the statistical system and the last to be taken away because of budget constraints.

The global statistical system to examine the problems which are external to the national borders, the core items and the associated data are needed. The generalization of the global economics implies a happening within section of the globe influence the supply of food, the climate as well as the environment in different places. When they are being executed, the core items and its related data must form the structure for the agriculture and rural sections of the National Strategies for the Development of Statistics. Integrating agriculture and rural statistics into the national system, the set of core data items will be the starting point to develop plan.

The basic production statistics for the main crops item like aquaculture, livestock forestry, fishery product that goes with inputs of agriculture, data on socioeconomic, information on land cover and public expenditure begins with the naming of the core data. All are outline in the next section, it is then accompanied by a structure for countries to in co-operate their extra national requirements to the main data items and

to determine the rate at which both the core and national data would be provided,(Open knowledge worldbank.org).

#### **2.4.4 Associated Data Core Items Set**

The crop core items: Cereals like rice, maize, wheat, sorghum, barley, maize and others like sugar cane soybean including cotton are the core crops items. These contributes to major part of agriculture land use, total supply of food and also agriculture value. The individual production may differ significantly over time. Since they are several uses of their product not excluding bioenergy. The availability of food depends on the choice of choice of which commodity to produce. Their data requirements are, Area planted and harvested, estimated yield and production. Quantity available at start of harvest, cropland area that is irrigated. Consumer and producer prices, quantity use for home consumption, feed, food, seed for planting, fiber, oil, bioenergy ,imports and exports net trade and rainfall, crop conditions survey, and vegetative indices from satellite observation as systems of early warning.

**The Livestock core items:** These livestock core items includes, ruminants (sheep, goats, cattle) and then poultry. They are also the main source of food supply. The increased use of feed grain is as a result of the increased need of livestock product and despite the fact that, feed is truly an input to the production of food, this can result to a situation in which feed production measures up with food production. Hydrocarbon release are also from livestock as well as water pollution and disease risk .Policy decisions can influence all these issues. Production and consumer prices, net trade of imports and exports, livestock product like eggs, milk meat, and wool, animal birth and inventory are some of the data requirements for the items, (Open knowledge worldbank.org).

**The Fisheries and Aquaculture core product:** They also plays a major role in food demands. With aquaculture, the use of both land and water resources are included in its production. Fishing provides a means of living for both inland holding and small –scale. The needed data includes area cultured, production information price, imports and exports, net trade, quantities landed as well as quantities discarded, number of days engaged in fishing, food quantities, non-food quantities and cost,(Open knowledge worldbank.org).

**Forestry core production:** One of the major land use is forestry, it's provides also income and its responsibility is important in the identification of factors influencing changes in climate. The needed data for this is forest and woodlands area, number cut off, with prices to related land to non-agriculture holdings and separate uses, (Open knowledge worldbank.org).

**The agriculture core inputs:** Agriculture products core inputs includes labor, water, energy, agro-chemicals and stock capital. These are considered core inputs because they combined with other inputs to give indication of productivity of agriculture, which are essential for the monitoring and evaluation process so lessen poverty and hunger, (Open knowledge worldbank.org).

The data requirements include: Fertilizer and pesticides quantities used, consumed, energy and water, capital stock like machinery classified by purpose (i.e. tillage and harvest), the number of people group by sex and age. Hired agriculture labor by household, the number of household members engaged in agriculture.

Every country however, has to include which core item to add to its national system. They should include other items of importance to its well-being then decide how often data would be produced and the country's needed coverage. As an example, fruits and vegetables are not included in the core data or other items like livestock that forms part of a nation's food needs and domestic earnings, every nation must think through in what way such items could be added to its country system.

For those item that combined accounts for more than three- fourth of the country's value for production annual data are generally required. They should include items which production can fluctuate greatly from year to year especially if the fluctuation are a main source of risk susceptible to households and the supply of food. They should represent as well data that contribute to meaning full proportions of land use and that has an immediate effect on land use and the environment, including items that contribute to only minor portions of the nation's land has sample plan and resource, implication or are provided by only a small number of household or holdings.

As shown by sample theory, the relative variance of the mean estimated is approximated by the relative variance or the positive sample unit plus the relative variance or the proportions estimated of the positive population units.

$$CV^2(Y) = CV^2(YP) + CV^2(P) \rightarrow \text{equation 2.1.}$$

Where,  $Y_p$  represent the mean or the positive response and  $P$  being the proportions of the population having the item, considering that only one-third of households or holding have a particular item to attain the level of precision, the size of the sample would be four times bigger than when three-quarters have the item. The size of the sample become three times than what is required if a third are positive then will be 12 times bigger than if  $(p) > 0.75$  for a similar level of precision, when just one-tenth of the household or the holding has the item.

The conclusion is that, generally, inferior, also comparatively unusual items has to be omitted from more frequent surveys, they should be limited to only the normal census of agriculture. Then that would be exceptional if the sample frame contains sufficient data that can be used in the survey design to target the rare items. Indicators for monitoring and evaluation rural development within the source book (2008) would to be reviewed as the next step and involve those items important to the situation of the nation. Every country then decide on the level of details to be produced for the core plus the extra items included and the level of geographical coverage.

The socioeconomic characteristics of the agriculture and rural household should include household income as key measure of the economic well-being of the rural household to guide policy decision about the development efforts to reduce poverty.

Also, they should require periodic data on population, age, gender the number of households, educational level, and employment.

The fundamental way to evaluate agriculture's effects on the environment is to monitor changes in land cover and use, data are therefore refined annually because land cover does not change rapidly. The entire land mass of a nation complete coverage with these classifications, crop land, grass land, forest land, wet lands, settlement, other land and water should be provided with the use or product mapping or digital data from remote sensing.

The availability of transport services, communication, roads and extension services should be included because public expenditure in the rural area on subsidies, infrastructure, health and education are core items, (Open knowledge worldbank.org).

#### **2.4.5 The Determination of National Priorities: Scope Content and Frequency**

Core items that are not easy to produce or cost so much to produce and which does not change much over the years data would not be required every year. To meet national data need agriculture and rural development nations would have to add to the list of core items additional items.

The global strategy to determine national priorities for content, scope and frequency is provided by the framework. It will also establish the regularity of items not specified. At the stage of establishing the integrated survey structure where the source of data would be indicated, frequency requirement will also be considered. The required agreement considering the level of frequency of geographic detail and other breakdown are time and available resource result. For each item, these categories need to be considered. The provided level of geographic detail or other breakdown is where the sample would be drawn by the percentage of holding or household having the item. The resource required and the methodology to be use would be influence. The geographic detail that can be provided will be limited because annual data collection will rely upon sample surveys.

Within country administrative area data like province should be added to the national structure because policy makers would need them, by this point every nation would develop general impression of what their country agriculture statistical system together with the forestry, fisheries and the rural the sectors is like and incidence and coverage of the data generated. This final picture would be shape with inputs from policy makers and other users of data. Requirements of data users, conceptual framework and the action to develop a national statistics strategy has been outlined. The section next, explains the processes and plans to coordinate agriculture into the national statistics system to enhance agriculture statistics, (Open knowledge worldbank.org).

#### **2.4.6 Pillar Two, Integration of Agriculture into the Country's Statistics System**

This section gives an outline of the statistical methodology to provide statistics of agriculture that will satisfy the needs of makers of policies and other stakeholders in agriculture. The theoretical structure is considered as basis. This framework would be used as a design for the procedural prerequisites for the development of agricultural

statistics in the national program. The harmonization with the main approach explain below looks at the quality measurements, which includes fullness, accuracy, relevance, accessibility timeliness, coherence and comparability.

The procedure for enhancing agriculture statistics will start from the considering agriculture in the country's system of statistics. Achieving this is by establishing what is termed the master sample frame concerning agriculture to guarantee the importance, also completeness. It is use in executing an integrated system for collecting data to provide accurate, data that is timely, that are consistent and can be compared, and a system for information distribution for guaranteeing easy access. A drawback of the present statistical system in both developing and industrialized nations is that data provided by the different sectors use dissimilar surveys and frames. Such segmentation of the data according to sectors does not allow the evaluation of an effect on a particular intervention in one area on the. Data collection are many a time, carried out on ad-hoc grounds with no bridging to what is called the "master sampling frame" or the application of geo-referencing for such data collection. This however makes it not easy to harmonize data from the various sources for detail analysis based on the cross tabulation of several variable.

The data concerning livestock and production of crops are taken through different sources that are from different samples, this data does not have basis for accessing dynamics of holders that provide both livestock and crops or for matching up to holders that are specialized in one way or the other.

Surveys on households are normally carried out differently from production surveys without integration, and very small sample size to group the data according to farm and rural settings. The integration of these findings are not made into a single database for user's access.

Different government organizations are normally engaged in agriculture data compilation and Analysis of agricultural, forestry and fishery data without harmonization. Although the office of the national statistics might be conducting census of agriculture, the annual production data may be from the ministry of Agriculture involving other sectors like the aquaculture and fishery may be from a different organization and may be overlooked or ignored by the national statistics office. In other situations, separate organizations provide data form the same

organization, with dissimilar results, obscuring the use of the data and makes it not easy to group the findings between nations. If these institutions use different means to populate their databases, the implication is that the results would vary also at the international level. Getting away with duplication of work, avoiding discharge of contradictory issues, and guaranteeing the maximum usage of resources, definition, concepts, explanation and classification become regulated, more data collection across sources these can be solve by the integrated statistics system. The standards of enabling more data collection across sources, such are benefits of integrated data system in addition to the changing requirements for comparable and reliable data in the framework of the global strategy and internal worry on environmental concerns call for the urgency of a national statistical system integration. The world-wide strategy for census of Agriculture (FAO 2005b) fight strongly in support for the creation of this system of integration, in certain countries, centralized governmental structures exist and national statistics offices upholds a major duty for the agriculture statistics.

Although, the use of the term “Agriculture in the approach is inclusive of a wider coverage to embrace aquaculture, fisheries and forestry, the centralized responsibility may not all the time satisfy the requirement of the main ministry like the agriculture ministry. As such the responsibility on statistics in most countries are decentralized with the statistics on agriculture produced by the agriculture ministry. The two systems have merits and demerits. National statistics offices has skills and experience with statistical strategies and sample frame that the other ministry do not possess. But, the other ministries are more knowledgeable about agriculture, fisheries and forestry, and land utilization. The aims of the global strategy is to recommend a structure for harmonization that increase the powers of the two systems. The harmonization of agriculture into a national statistics offices will be grounded on statistical approaches using tools that builds a strong connection between findings from various statistical processes and several statistical sections. This can be fulfill by creating what is known as a master sampling frame, the acceptance of sample design like overlapping samples and the harmonization of questionnaire design and surveys.

The master sample, the sample plans and the framework of the survey has to be thought of alongside since there are options to be considered, like whether to observed similar farms and households or to consider separate samples, and gather some of the similar variables. It is also imperative that countries allow some flexibility in the way the

sample frame and the final survey procedures are executed to reflect their national needs and also their statistical capacities. The statistical approach to be used also requires to consider some fundamental data quality measurement – consistency, timelines completeness and accuracy.

Issues for quality measurement will be taught of in the strategy development. The sections, following gives the strategy to develop the master sample frame, accompanied by the sample and survey structure to realize the harmonization, the underlining strategy, also stands of latter improvements on agriculture statistics in addition to satellite imagery use for observation of land use, crop areas estimation, find the provision of dynamics in growing conditions to mention but a few. Also, developing a Global Positioning (GPS) makes it possible for geo- referencing observation and data gathering to the land cover being produced by the satellite imagery. The appearance of the Internet and other new technologies, example, the use of Personal Digital Assistance (PDAs) mounted with GPS devices for data collection and the link to databases, has great future for lessening the time between data collection and dissemination with enhanced quality, (Open knowledge worldbank.org).

#### **2.4.7 Developing a Master Sample Frame for Agriculture Statistics**

The building of the master Sample Frame begins with the description of the population parameters, that is natural environment and the physical land mass of the country, the agriculture economic output including the rural and farm population well-being. For the purpose of data collection, the population has to be explain in reference to the statistical measurement units. The unit of statistics described in the theoretical structure involves the farm or agriculture holding, the land parcels and the households. The framework has to be connected between environmental, economic and social dimensions and their respective units of statistics. This includes the requirement for farm and household geo-referencing. All these concerns are taught of in the creation of the master sample frame.

The developing countries normally use the listing or administrative area created for the population census as sample frame. Sample of farms are acquired by initial choosing of enumeration areas, checking them for households and farms before choosing a subsample for the survey. Other nations make farm registers for the purpose of sampling and should allocate substantial resources to maintain them updated. An uncommon

method is the area sample frame, which is completing the countries land mass divided into sampling units (Gallego, 1995). Most of the needs suggested by the global strategy asked for increased adoption of area frame approach. A final method to use several frames (FAO 1998), to establish a master frame that takes advantages of the registers and area frames.

The master sample frame should provide the foundation for the choosing of probabilitybased sample household and farms having the capacity to connect farm dynamics with the household and then link the two to land cover and use measurements. The approach of adopting the population census proposed for the world program for agriculture census (FAO 2005) will also satisfy their need. If the households from the population census are reference geographically and consider as the sample frame for census of agriculture and connected to satellite images of land use. At this moment only a small number of countries have considered agriculture in the population with a farm, and if so, what are the implication of type, size and the land location (census enumeration areas or unit of administration)? This data can be used to establish a household and farms register, include their land linked to geo-reference census enumeration areas or administration units. In enumeration areas of census in agriculture information are obtained, nonfarm households must be added in the register. This will create a link between agriculture data and all the characteristic included in the population register. However, connecting farm census data and population censuses data is a powerful tool for analysis of data. Different problems will be required to be addressed. Initially, confidentiality laws may restrain how the census data could be used to establish a master frame for agriculture. Also the register will have to be complemented by a register of institutional and commercial farms not related with household so as to produce a whole region of agricultural surveys.

An imperfect approach also use the farm or household register as a feed into the agriculture census. Thereafter, the master frame for agriculture will be similar as defined below when agriculture census is the foundation. The establishment of the master sample frame with the use of agriculture census also includes the need to relate farms with household and both with the use of land. Previously, the farm was the reporting unit for agriculture census. The initial step for the collection of data was not used just to define the farm alongside with getting production and economic evidence but to get census information also.

Accordingly, information presently available to the FAO, just greater than or equal to 50 countries from total of 189 members Countries have strategies to implement agriculture census during 2006 – 2015. Given these limitation it is necessary to have optimized approaches to build the master sample frame for agriculture, the process to use begins with a long-term focus for how the master sample frame for agriculture can be established. The process is careful of varying levels of capacity between countries. Hence other approaches to build the master sample frame are produce as well. The creation of master sample frame starts with the requirement to connect the social and economic dimension of agriculture with those having relation to land cover, getting the satellite imagery, the area of the country is a necessary starting stage.

The land cover as produced by the satellite imagery should be group into main categories like land cultivated, grassland, wonderland, urban area, idle land and so on. Except that land use is varying fast such imagery has to be updated regularly. This initial step in developing digitized land cover database has to perform an outstanding role in attempts to develop a statistical capacity. When the land use mapping is done, the next thing is to geo-reference the population and agriculture census enumeration area to the satellite imagery. Countries, township, districts and villages have to be georeferenced so that they are related to the land-cover imagery. This enhances monitoring of land use over time and can be used to associate land use to local administrative arrangements. This Information becomes an essential part of the master sample frame of agriculture.

The integration assisted by the use of Personal Digital Assistance (PDA) equipped with GPS for the collection of data. The frame of 5.2 million agriculture holdings is been referenced to the households listed with the population census. Every agriculture holdings can be visualized by using Google Earth images together with the grid of the agriculture census enumeration areas. The sample frame of agriculture holding including their individual coordinates and the list of enumeration areas surveyed by the census of agriculture constituted the area frame and turns the master sample frame concerning the households related to the households and farm features. The scope of the census have to be inclusive both on small- scale and commercial farms, including subsistence farming households. The objective should be the farm listed on the census be considered in creating a register and all farms must be related to a household, if not an institutional or cooperate farm.

The issue is that, the site for collecting data is the farm head- quarters or household whose distance from the holding causes problems for geo-referencing every land holding to land use. Thus land related to each farm and related household have to be linked to the right geo-referenced census enumerated area or administrative settings or both. In this case the master sample frame of agriculture will be a register of households or farm and commercial farms enterprise which are geo-referenced to administrative units or enumerated areas. The census is frequent every 10 years. It will be important to modify the register in the short-time interval using administrative information. An option to this procedure is to use multistage sampling in which the first stage is administrative unit or census enumerated area. The first stage sample points can be checked annually for updating reasons.

In conclusion, the master sample frame for agriculture can be created in different ways. The common feature for the three procedures mentioned above is the geo-referencing of census enumeration areas and administrative units to digitized satellite imagery defined by main land cover. The area frame sampling units can be related directly to the land cover definition. The land related with farm households enterprises in the administrative or census register is indirectly related to the land cover through the mapping to the enumerated area or an administrative unit. A long-term objective could be to geo-reference all parcels or land related to agriculture holding directly to the satellite imagery.

The main principle is that, the master sample frame be the bases for all samples for survey of agriculture holding, farm households and non- farm households. This implies the sample can be constructed such that data can be analyzed across surveys. After developing the sample frame, it should be likely for several institutions in the National Statistics System to get the Master sample for the purpose of survey with another principle guiding the resulting data to be available for analysis across other data collection, (Open knowledge worldbank.org).

#### **2.4.8 Integrated Survey Framework Vision**

The section explains a vision for the integrated survey framework. The entire survey framework contains the sampling strategy, the survey instruments, data collection procedures, analysis and estimation. It also consider the source of data in addition to

sample survey that produce input into the survey framework. The complete strategy is also given. The practical and methodological components will form part of an execution plan. The regularity and timing of data collection are major challenges to agriculture statistics.

The production cycle of crops are different and seasonal, while the production of livestock determined not only the individual reproductive cycle, but again the constant production of products like eggs and milk, aquaculture has similar characteristics to livestock production. The force of rural labor is also influenced by the seasonality of agriculture which affects chances for work and income. Data collection timing affects the quality of the data, particularly if a long recall is needed.

As such the collection of data must be at the same time with harvesting. For instance if the yield of crops are obtained through crop-cutting surveys then these have to be done just before harvest. Capturing fish needs regular sampling and surveys for example, twice a week or once every five days, so that the data will reflect development like regular variation in prices structure.

The development of an integrated framework starts by first taking into account the set of core data needs accompanied by the other information required by each country. The minimum set of core data involves statistics concerning production of major crops, livestock, fishery and aquaculture and forest products. The next need is for economic data on the agriculture holding which includes farm inputs and outputs. The third requirement is the collection of data on fertilizers use, other chemicals, and methods of tillage and land use operations to observe the effect of agriculture products on the environment. The fourth requirement is the measurement of the social well-being of the rural and farm households. The conventional procedures is to choose independent samples and carry out separate surveys for each of the groups. However, the ideal sample design normally leads to the choice of sample specific, crop, livestock, and the irrespective of environmental, economic and social surveys it constrains the analysis of data across the separate categories.

Single-purpose surveys usually makes it simpler to target the chosen sample livestock or crop particularly where the two are not found on most farms or when present differ greatly in size, it is not easy to apply stratified designs using many different measures of size, latest development in sampling theory produce an option using chosen

probability proportional to size for a number of several variables. This is termed multiple probability proportional to size (MPPS) because the size related to each farm or enumerated area is determined for many items of interest. The use of the method in China is defined by steinen (2007). The use of MPPS is suitable for multipurpose surveys in which the population sample points each have only a subset of the items of interest. For the intention of data analysis, it is necessary to choose one large sample to obtain all the data for production.

MPPS sampling method taking several variable from the census of agriculture used to sustain an extended survey program and to co-ordinate the statistical requirements for various levels of government, the holding's economic situation, its impact on the environment and household social well -being. It can also be necessary for similar sample to be used for a long time for longitudinal data analysis. As the MPPS sample design gives the foundation to use a single sample at the same time it needs long and complex questionnaires to cater for all items of interest. For this motive, a process to collect data for some core items annually added with the seasonal data collection for items indeed to enable analysis of data across, (Open knowledge worldbank.org).

#### **2.4.9 Implementing an Integrated Survey Framework Steps**

The integrated framework must be built on the set of core and national data and the determination of how often they are needed.

Identify the minimum set of core data items for which at least annual data are needed. For those Items not required yearly, classify them by types with economic variable like the structure of farm income and expenditure, measures of the environment such as the fertilizer and other Chemicals usage, water and land use, social variable like household well-being, income and other Items of domestic concern (minor livestock and crop items for instance) Data on these will be obtain from rotating panel survey centered on subsample of the main survey.

Select a duplicate for the yearly core items employing” multiple probability proportioned to size” (MPPS). In another way as an alternative of choosing one large sample, choose different replicates. This permit the addition of more sample points in the data collection over time for longitudinal assessment. This also makes longitudinal data available. However, it restrict the frequency for interviewee worry concerns.

Develop a data collection instrument for the annual core data acquisition. Annually, the main instrument must include additional question concerning one of the type of issues indicated above. For instance, in the first Year, Year 1 replicating 1 through 5 would be used with the main instrument which too will include Major questions on economic variables. The main instrument can either contain all the needed information or selection of subsample for in-depth data collection. For the second year, year 2, replicating 2 through 6 will be look at making use of the main instrument would also include questions on environment concern. By the end of the fourth year all the subjects' issues might have all been added.

Annually core data items would be connected to a set of panel data. Again, be aware that beginning with fourth year, at least one of the replicate might have been studied by all of the rotating panel instrument including the core questions

The survey design above gives a structure for the collection of core data items some on annual bases. And others on 4-year rotation. Every country would have to come out with its own decision concerning the content of every component. After the above plan is implemented, the next step is considering whether some of the data collections for annual core data items should be carried out more often at the course of the year. For instance a data collection would be carried out at midyear to provide crop yield data before harvest, and another after harvest to get the final production data and stock.

Also, chance is given by the integrated survey framework to compare sample unit data across time. Apart from the framework providing the chance to use optional estimators, it is also produce a major evaluation tool to enhance quality, Built on the sample design from the basis as an unbiased estimators. All can be supplemented by the use of the regression and ratio estimators, or estimators based on models. From the use of the census findings, the reliability and quality of the data can be improve by the use of multiple estimators.

The outline of how the annual and seasonal surveys are linked to the data system are provided by the survey framework. Be aware that yearly survey could also be undertaken with use of annual survey subsamples. The extra data source that has to be added to the whole framework are also considered by the integrated framework. The administrative data: intervention by government like regulation and legislation and subsidies normally requires agriculture holders to document and report information on

product, cadastral and land ownership survey provide important information for the creation of registers. Food and animal health inspection, and data on trade also gives input to the utilization reports.

Remote sensing data: The indices of vegetation that shows complete crops conditions and information on the dynamics in lands use and cover. If the remote sense information is to be used as an estimator of crops and areas then the survey framework must include the request to show ground data.

Agriculture business: Data on utilization and price information are source through Agriculture business.

The Technical decision and wind shield studies and methods employed to obtain data from people whose decision determines the assessment of agriculture conditions for examples the sourcebook (World Bank 2008) Looks at a process in which experts travel a given route periodically and document the performance of crops, which offers an input into crops yield forecasting.

Survey of communities: The world program of Agriculture census (FAO 2015) gives an outline of how village level data can be collected. Such data are inclusive of data concerning some services, also Infrastructure accessible to Agriculture households and existence of shortage of food, regularity of national calamities.

The annual core set of data items on production of agriculture and other variables decided by the national statistical system are supplied by the integrated survey framework. Longitudinal assessment of core data are permitted by the survey framework and it provide link to collected data considering economic, environment and social concern. Using the master sample framework guarantees that the collection is linked to land use also. Another pillar of integration is the management of data that make maximum use of their analysis, (Open knowledge worldbank.org).

#### **2.4.10 The Global Strategy Data Management System**

The system for managing data satisfies three tasks accessibility to official statistics for the purpose of dissemination, storing and retrieving research findings and the accessibility to data on farm, household, and geo-referenced data for investigation.

The data management system help the dissemination of data to guarantee the official statistics are really existing, easily traced by source and time, and one easy to compare for the purpose of aggregation within and across nations. There should be a database or a database should be integrated to prevent duplication of official statistics because several institutions are involve in the national statistics system. Such duplication can result to several facts making misunderstanding between the users of data. These data must be an integral component of FAOSTAT, the FAO statistical database which become a public property for data access.

Make available the structure for the housing of the data and geo-referenced data on land use including supporting and administrative and other data origins. Not all survey findings are disseminated, but they should be accessibly for the purpose of exploration and analysis. The survey and sample design allows the use of regression and ratio Estimators needing links to former data as shown above. The maintenance and storage of the various farm and household survey results and the relationship between the several set of data that are geo-referenced to common land use mostly by the survey management system. For Instance, there will be data from the rotating panel survey and five successive years of main production data from similar sample unit. The data analysis capabilities of the data set will be the source of power for the integrated survey system. The other source of data should be included in the data management system for they are important for the compilation of reports on utilization and supply, like the food balance sheet as well as other economic and environmental accounts. The uniformity of data from several source is guaranteed by the use of these accounts. Again, it helps the integration of agriculture statistics into the country's statistics system through gathering these along including indicators from different areas that used similar explanation, classification and concepts including procedures in accounting. As the database itself progressed, the benefits of the integrated database will be increased with time. It enables detailed analysis over time.

The use of this can increase data quality by comparing survey information with data obtain from census or between surveys. The establishment of the integrated survey framework, the master sample frame and integrated database as mean of integrating agriculture into the national statistics system, countries would be expected to examine the recent structures of governance. To satisfy issues of integration with guarantee to statistical systems to stay overtime, (Open knowledge worldbank.org).

## **2.4.11 Pillar Three, Agricultural Statistics Sustainability through Statistics**

### **Capacity Building and Governance**

Pillar three of the world-wide strategy aim is to build the governance structure and capabilities which forms the bases of a data collection system that is sustainable. The success or sustenance of any statistical system fully relies upon continues with predicated support that guarantees constant backing for the collection of data at the right times. When it shows to be trustworthy and important to the needs, decision makers and other data users are more probable to encourage the system that provide it to sustain the need for the data. By this, continuity of any data collection systems is generally dependent on the need for the provided data including any support or assistance that is needed as fulfillment requirements. Present issue of poor quality data account to its restricted application in nations throughout the world. Such is an essential core issue describing the limited Agricultural statistics financial support, getting to know the country's level need of statistical information. What is needed to give the statistics is however, a major component of the sustainably of a statistical system of agriculture. If the statistical system respond to users and offer statistics that are important, accessibility, timely with high accuracy that satisfies their demand, requirements can be backed up and supported. Also support of donors with funding will still be relevant as enhancement to the National statistics systems, core data collection must all time turn out sustainable by the use of country's resources. Most countries will be expected to establish an appropriate governance system and to strengthen their statistical capacity across the several institutions involve as a way of integration of agriculture in the National statistics system, (Open knowledge worldbank.org).

### **2.4.12 Governance of Statistics**

The involvement of multiple governmental organizations in agriculture, forestry and fishery data collection, has made several nations to establish an organization to coordinate statistics. In countries where centralized units exists within the National statistics system to manage the collection of data and disseminating being a component of their main duty in support of agriculture as well as other statistics management process, might still being needed to guarantee that requirement of the line ministry is

completely satisfying the statistical system. In many countries, although statistical roles are decentralized, and the Ministry of Agriculture provide statistics of agriculture. The two, centralized and decentralized systems has merits and demerits. The National statistics office, who has the skills, and experience applying statistical process and the use of sample frames is the experience that other sectors normally fall short of. But the other ministries may have better expert know-how concerning agriculture and other related sectors like land use, forestry and fisheries. The global strategy general objective is to establish a framework of integration that empowers the intensity of the two fields of knowledge. Governance at the country's level includes the establishment of a country-wide statistical system that embraces the other various ministries and the other organization which produce agriculture related data. With the situation on agriculture statistics, such must involve the ministry in charge of agriculture forestry and fisheries including all organization that collect data related to agriculture. The employment of the coordinating system is a guarantee that the various data providers follow generally accepted norms. The duplication of resources and efforts and also the release of conflicting data from the various reporting organizations are prevented with the compliance of these standards. The statistical integrity is also guaranteed by the availability and accessibility of the data. This mechanism should come out with a common say within the structure of the National Statistical System asking for resources for Agriculture statistics development. The provided statistical governance must allow the organization engaged in agriculture data collection to in co-operate into the organization of the country's plan for statistics development. The establishment of a governance body like the national statistics council will organize the efforts of all stakeholders of statistics. The council should comprise of the national statistical office, the agriculture ministry and all organizations producing data or including administrative data to together organize and coordinate the advancement and usage of the integrated database, the general survey framework with the integrated survey framework. It can happen that some organizations are well match for or the organization of a specific data types. All data irrespective of which organization or agency that provide them would be centered on what is termed the master sample frame in a harmonized system of surveys with the results housed in an integrated database. Each institution responsibilities be explain clearly and must be based on its technical experience and

knowledge in specific areas as aquaculture, crops, fisheries, livestock, forestry, land and water.

The integration of agriculture into its country's National statistics system does not imply that every responsibility should be on the national statistics office, the agriculture ministry or in a particular agency but it means that the organizations with their data requirements overlapping, accept all the three that is the database, the integrated survey framework and the master sample frame roles.

Agriculture statistics integration into the national statistics system has different implication to international organizations. They would have to submit that data request to national statistics system and not to a particular sector institution concerned. Consolidating data needs between different international organizations can lessen the extent of overlap and reduce the data reporting needs. This policy has several implications to the funding organization not excluding those that are in supported of statistical capacity building. Furthermore, their efforts would have to be focused on governance structures organized in each country rather than dealing directly with the individual sectors.

Every country national statistical council will have to handle these cross-cutting management operations.

Revise or plan a national program that improves statistics, outlining in the National statistics system the responsibilities of every organization.

If needed, put in action or the revision of existing legislation concerning the powers as well as roles for statistics that is including the legislation and regulation with respect to data confidentiality.

Establish a plan to seek the support from the public, the funding and continuity that a statistical system may require. In particular among policy makers and other stakeholders. The aim is improve county's buy in of the preparation strategy to offer data and product.

Provision of standard, salary scales, wages level and professional development needs in the creation of a National statistics system for agriculture statistics.

Find out all roles in the preparation and the maintenance of the master sample frame, assigning roles for data management system and verifying the framework of the integrated survey to be carried out.

Come into agreement about the scope of coverage, content and also the frequency of delivering national statistics system with the core items in respect to the policy makers and other stakeholder needs.

Creation of a framework to guarantee the supply of data determined by uses and satisfies user needs for relevance and quality in general.

Lease with FAO and other external agencies as well as funders to plan an in-depth evaluation of the present national strengths and establish a framework for statistical capacity improvement.

Taking suggestions from regional and international organizations, put up funding needs for capacity strengthening, master sample frame development and cost estimate needed to maintain and sustain the integrated survey system.

The integrating of agriculture into national system will divert the attentions given to statistical capacity building. This capacity building that is presently focusing basically on the office of national statistics. The engagement of statistics system of Agriculture within the system of national statistics then turns these statistics a key part of the country's plan of statistics development, (Open knowledge worldbank.org).

The competency strengthening part for the execution plan of the global strategy should consider agriculture data as a purpose of comparability, relevance accuracy availability, accessibility, as well as timeliness. The various measurements regarding quality concerns should all be integrated within the system designed for agriculture statistics, and they must also all be directed towards the support of strengthening the management capacity. The seasonality of agriculture production gives a unique trial for agriculture statistics, particularly the accuracy at the national, regional as well as international levels to discover places of priority, the requirement of resources and time frames. To most developing nations, support from funding and technical cooperation organizations are requirements to support effort of capacity building. The building of this capacity starts with support to:

The development of a national strategies of improving statistics and where such strategies already exist, review to found out where changes and updates are required. Establish a link of statisticians and supporting staff in addition to those collecting data.

Educate staff on aspect of data management like statistical methodology for sampling, design for survey data collection and compilation and data analysis.

The development of data management processes, development and maintenance of the master sample frame and execution of the survey framework.

The provisions of computers and access to appropriate software including other user friendly technical equipment.

The provision of satellite imagery geo-referenced according to land use.

The dissemination of findings and readiness to respond to stakeholder request.

The strategy, is a come to stay process which is liable to encounter several problems and the need for a concerted effort from every stakeholder, timelines and quality measurements. The need for accuracy and timelines which often conflict will not be easy to resolve. The quest for certain data types like estimates of time, crop production information reduce the time use for the collection of data and analysis that bears implication for data quality.

Executing this will need some expertise that would be obtain (or maintain) in most developing nations. The application of remote-sensing, an integrated survey framework design, experienced technical personnel are required for the use of data management systems. Whereas, creating and maintaining technical capabilities in countries will be a problem. There options exist, among them is to creation of regional centers to produce remote sensing abilities, creating statistical processes and steering the execution of information technology in offering support to countries institution. The building of these places can be point of focus for funders and all international agencies. The fulfilment of the whole global strategy therefore need both country and global support with dedication to carry out the establishment of the statistical capacity, the need to revamp many countries statistical systems and the improvement of others . The strategy is centered on an in-depth country evolution that outline specific activities, (Open knowledge worldbank.org).

## 2.5 Agricultural Statistics System in India

The role of agriculture is important to India's economy (Ministry of Agriculture India). More than 70% of rural population depend on agriculture as their livelihood. In combination with forestry and fisheries, agriculture contributes to about 17% of India's Gross Domestic Product (GDP), this is largest single contributor. The experts from agriculture constitute about one-fifth of the country's total export. The collection and maintenance of agricultural statistics take greater relevance in view of this predominance position of the agriculture sector.

The agricultural statistics system in India is well enabled and has an internal recognition. Agricultural statistics at the state level is controlled by the state Agricultural statistics Authority which plays a major role in the collection and compilation of agricultural statistics while at the all, India's level it is overseen by the Directorate of Economics and statistics Ministry of Agriculture (DESMO) at the central is the main organizer for such activity. India agriculture statistics system is comprehensive and produce data on several topics like area cropped and production, Irrigation, land use and holding, market price, Fisheries and livestock.

Statistics on Crop and Land use: India's long standing tradition of producing comprehensive series of crop and land use statistics due to its excellent infrastructure is through complete enumeration of every activity in the villages in each of its specified cropping season.

Sample survey approach is carried out as a means of crop yield estimation in the country. Scientifically design crop cutting experiment are used as means of yield rate estimation and are conducted under the scheme of the DESMO entitled General Crop Estimation Survey. In recent times, there is deterioration in data quality and timeliness in collection of agriculture statistics, it has not been functioning due to administrative challenges.

Crop Forecast: There is a National Crop Forecasting Center set up by the Ministry of Agriculture which aims at examining the existing mechanism of establishing forecast of major crops and the development of more objective procedures. To replace the present system, the center takes in consideration an objective Scientific Forecasting methods, Information on weather conditions with the supply of agriculture inputs, pests and diseases prevalence. Advance estimates of crop area and production through

seasonal forecast are release by the ministry of agriculture with regards to major food and non-food crops. Four forecast are issued quarterly based on preliminary eye estimation, analysis of priority enumeration of area crop cutting experiments.

**Data on Livestock:** Livestock data is collected through livestock census by an entire enumeration of all households in respect of livestock numbers, poultry, fish, craft and machinery. The information is obtain through numerical enumeration according to age, sex and breed. DESMO also coordinates a centrally sponsored livestock census. Integrated sample surveys are carried out by the Department of Animal Husbandry for the estimation of production of major livestock products such as meat, eggs, milk and wool and also the production of eggs and milk, (Ministry of Agriculture India)..

**Data on Fisheries:** Currently, information on items such as aquaculture, feed, seed production, fish production, prawn production, fish catch disposal, processed and preserved data are collected. The estimation of fish production from the marine sector is made by the use of a multi-stage sampling method. Deep-sea fishing data are collected through reports furnished by trawlers and other fishing vessels. There are different attempts to develop sampling method suitable for estimation of fish catch data for inland-fishery, (Ministry of Agriculture India).

**Irrigation:** While the Irrigation statistics in terms of source -wise area irrigated compiled by DESMO through village records as part of annual area statistics, the Ministry of water resource compile irrigation statistics in terms of irrigation potential created and utilized in disaggregated components of major medium and minor irrigation sources, (Ministry of Agriculture India).

**Land Holding and Inputs:** Land holding statistics is collected and compiled by the National sample survey office (NSSO) by way of decennial Agriculture census. Other important source of such data are survey conducted as part of the quinquennial census, (Ministry of Agriculture India).

**Price Statistics:** The collection, compilation and dissemination of price data on agricultural commodities is the responsibility of DESMO. Price data collection are based on daily and weekly wholesale prices. Farm gate prices and retail prices of some essential products, (Ministry of Agriculture India).

**Horticulture Statistics:** DESMO, is also responsible for crop estimation survey on fruits and vegetables in some states operated by a centrally sponsored scheme.

Secondly, estimates of area of production and prices of all important fruit and vegetables based on reports furnished by the State Directorate of horticulture and Agriculture are compiled and publishes by the National Horticulture board. Local level officials dealing with horticulture and reports of market arrival in the major wholesale fruits and vegetables markets provide the estimates which are based on informed assessment. India also collects important statistics like Forestry, Market surplus cost of cultivation, markets arrivals and others, (Ministry of Agriculture India).

## **2.6 Agricultural Statistics Systems in Japan**

It is Agriculture, forestry and fisheries industries which employs fewer and fewer people annually over the course of Japan's economic growth and their share of Japan's Gross Domestic Product GDP has decreased over the years. Agriculture output of Japan in 2012 stood at about 8.5 trillion yen an increase of about 3.4 percent from the previous year. The value of crops too was 5.88 trillion yen, 4.2 percent rise from the previous year (Ministry of Agriculture, Forestry and Fisheries Japan)

Administrative Framework of Agricultural Statistics and Methodologies of Agricultural Surveys are Surveys on Vegetables and Fruits Wholesale Markets and Livestock Products. Also, Statistics on livestock, Statistics on milk and dairy products, Survey on Prices, Census of agriculture and forestry, Survey on farm management and economy, Statistics on crops Survey on movement of agricultural and Survey on stocked of rice on commercial farm households.

### **Methodologies to Promote Accuracy and Meticulousness**

Local offices continue to play significant roles because agriculture is vulnerable to climate conditions which are different among regions on long-shaped land in Japan, staff has expertise based on administrative experiences on agriculture.

Also Staff in local offices can get information timely close to each farm through frequent communication with local citizens and governments, senior enumerators are eligible to implement surveys, with training seminars and on-the-job training by staff as well as their original capabilities, (Ministry of Agriculture, Forestry and Fisheries Japan).

## **E-Stat to Enhance Accessibility and Comparability**

To obtain statistical information published by the Ministry on the internet, and which allow users to view and download official statistics with convenient features like retrieving data by prefecture and municipality and drawing maps is provided by a one –stop on line service called the e-Stats, (Ministry of Agriculture, Forestry and Fisheries Japan).

### **2.7.1 Agricultural Statistics System in Sri-Lanka**

As per the National Income Estimates for the year 2009 the agriculture sector provide around 13.0 percent as its share of Gross Domestic Product (GDP) and about half of Sri-Lanka’s labor-force is engaged in agricultural activities. Sri Lanka has implemented agriculture based economic development policy in order to address the issue relating to the global economic slowdown and subsequent price hike in food commodities. A number of measures are being taken for developing agriculture sector particularly local food production, flower production and crop export sectors for the objective of national level self-sufficiency achievement and ensuing the security of food. Task forces have been appointed to achieve rapid growth in the production of some selected crops. Providing an accurate and timely data on agriculture sector has become a great challenge for Census and Statistics Department as to meet the increasing demand from many stakeholders in addition to the Government. In order to meet this requirement, several measures were taken, (Ministry of Agriculture Sri-lanka).

The Statistical System in Sri Lanka basically defined to be a centralized system in which the Department of Census and Statistics (DCS) is vested with powers for collecting, compiling and disseminating of every economic and social statistics in SriLanka. DCS is functioning under the Finance and Planning Ministry overseen by the office of Chief Executive, His Excellency the President of Socialist Republic of Sri Lanka. DCS is vested with powers for collection of data under the two ordinances namely, Statistical Ordinance and Census Ordinance. Agriculture and Environment Statistics Division of the DCS is also powered with the responsibilities to collect, compile, and disseminates data related to Agriculture sector overseen by a Director, under the overall supervision of Director General of Census and Statistics. The division obtains the data through three main sources namely, Sample Surveys, Censuses. Administrative records. There is

established statistical advisory body governed by any law on top of the DCS but the top management consisting of Directors represented for each discipline of the DCS is evaluated short term and long term programs in order to undertake statistical activities as per the vision and mission of the Department. DCS has island wide network for data collection integrated with the administrative set up.

### **Strengthening the Data Dissemination System**

A number of measures have been taken by the Agriculture Division in order to disseminate data in time through electronic media specially, by the means of website of DCS in addition to the circulation by print media. For this purpose the division has been able to get the services of System Analyst/Programmer on a full time basis. Upto-date data could be obtained through website: [www. Statistics.gov.lk](http://www.Statistics.gov.lk)

In this context the following two measures were introduced by the DCS during the last year.

Releasing “Agriculture News Letter” giving summary information along with a write up on current topics and published on the website.

Adopted a “Data Release Policy” for the benefit of researchers to facilitate the access to the micro level data.

In addition, steps are being in progress to make available the facilities for interactive tabulations of data through website.

### **Advisory Services to Outside Organizations**

In the instances where DCS is not been able to undertake and handle statistical surveys due to the limited resources, the Senior Management of the division had rendered advisory services to outside Department/Organizations to conduct surveys in the agricultural discipline as to maintain harmonized concepts. So that there will not be any ambiguity when analyzing the data with the other sources, (Ministry of Agriculture Sri-lanka).

## **2.7.2 Agriculture Related Surveys Undertaken During the Recent Past Census of Agriculture in Sri-Lanka.**

Sri Lanka has a long history of conducting the Agriculture Census and the first was recorded in the year 1921. The normal practice of conducting the Census is on decennial basis. Initial planning activities of the Census of Agriculture 2012 such as; evaluating the user requirements, drafting of questionnaires and manuals, budgeting, reviewing of data capturing techniques were schedule to commenced during the year 2010. The strategies of the next Census were basically focused on coping up with the requirements of data users and dissemination of data on time, (Ministry of Agriculture Sri-lanka)..

### **2.7.3 Survey on Tea Small Holding Sector**

Tea production and the export earning performs an essential task in the Sri Lanka economy. Sri Lanka is being the largest tea exporter to the world market which produces over 300 million kilograms annually having an extent over 222, 00 hectares. Few decades earlier, the largest share of production had been contributed by the large and state/private owned holdings but at present that has become the reverse side and it is dominated by Small holders of about 350,000 and their contribution to the production has risen over 2/3<sup>rd</sup>. As such the government obligation on uplifting of small farmers by assuring their living standards and providing a steady income has become a major concern.

To meet this requirement on timely and accurate data, number of measures has been taken by the Census and Statistics Department in collaboration with the Ministry of Finance and planning Ministry and other responsible agencies to strengthen the data collection process, especially at the grass-root level. Several directives have been made with the concurrence of the other stake holders who are providing the services for data collection in the field that is Department of Agrarian Development, Department of Agriculture, and the Ministry of Livestock to reinforce the primary reporters' duties, (Ministry of Agriculture Sri-lanka).

### **2.7.4 Estimating Paddy (Rice) Production**

Estimating the average yield and the production of paddy rice in Sri Lanka is performed on the basis of crop-cutting technique where the designated field officers visit the selected sample plots and carry out experiments as per the directives and instructions

of DCS. The size of the experimental plot where matured crop is to be harvested is 5 m x 5 m. Harvesting and measuring activities are performed manually in this exercise.

### **2.7.5 Estimating of Other subsidiary Food crops and Livestock numbers**

Presently, extent under subsidiary food crops, comprising seasonal crops, vegetables, fruits and minor export crops and the livestock numbers estimated annually/seasonally are not based on scientific surveys as such but based on subjective method oriented reporting system. As such the data are subject to questionable and final data process in a time-lag. Evolving a sustainable alternative scientific methodology to replace this conventional system is also one of the outstanding issues of the DCS, (Ministry of Agriculture Sri-lanka).

### **2.8.1 Agricultural Statistics Systems in Ghana**

The Ghana statistical service (GSS) and Ministry of Food and Agriculture (MOFA) are the two major organizations who undertake agricultural data collection activities in Ghana.

The National Agricultural Census; A national agriculture census is plan in parallel with the National Population Census under the authority of the Ghana Statistical Service (GSS) approximately every decade (10 years). But the last time it took place was in 1984, which is more than 25 years ago, (international food policy research institute fpri.org).

The Multi-Round Annual Crops and Livestock Survey (MRACLS), also undertaken by the Ministry of Food and Agriculture (MOFA). The collection of agriculture data is done annually at the districts level. MRACLS main objectives are to provide agricultural data from a sample of household. including institutional and commercial farming enterprise in every districts relating to small scale farming practices, livestock and poultry, farm inputs, assets infrastructure, labor utilization, sales, measurement of fields, and estimates of crop yield. However, the result of this activity only produce data for agricultural holders based on only field measurement, yield estimate in practice due to the inability to carry out the bulk of MRACLS survey questionnaire of late. That is to say that, the MRACLS does not generate in-depth information from holders in

respect to farming practices, infrastructure, inputs, labor utilization, assets, sales and also livestock, and poultry and other data concerning institutional and commercial farming as its original intention, (ifpri.org).

Furthermore, the raw data are not made available by MOFA. Only the aggregate information is shared through Statistics Research and information directorate (SRID). The weight of achieving Ghana's agricultural data needs has fallen on the MRACLS in view of the fact that Agricultural sample census has not been carried out in over 30 years. The MRACLS has continues to function during the time. But the scope of coverage of its activities has decreased tremendously of late because of several issues and factor that has seriously limited the quality and coverage of the information it supplies. ((Nyanteng and Aggrey Fynn, 2009)) state that inadequate resources in terms of financial and Human, and also limited logistics has contributed to the following MRACLS drawbacks.

The coverage of data collection at the districts is less that complete, MRACLS activities in the newly created districts are yet to be operationalize.

Due to resource constrains, the bulk of the survey are not administered. The normal MRACLS questionnaire is made up of five forms, thus:

Form 1: households and holder listing.

Form 2: holding enquiry.

Form 3: field area measurement.

Form 4: yield estimate.

Form 5: institutional and commercial farm enquiry.

But only the shortest forms 1, 3 and 4 are currently been used for reason to minimize cost.

Although data on the minor season is needed in the south, it is not collected.

The instrument (questionnaire) and field area measurement sample size has been halved from 20 Agricultural holders per enumeration area (EA) to 10

The crop cut (yield estimate). It sample has also been cut down from 20 holders per EA to 5.

The data rather in raw form are only disseminated in aggregate.

The data is processed for MOFA's needs before being shared out, although the raw data is collected. As such, it make it not useful for most stakeholders monitoring, evaluation, analysis or planning requirements and this limit data quality measurement.

Therefore, MRACLS activities presently generate inaccurately measured data for a small unreliable sample.

The main flaws that have reduced the institutional capacity and limited the MRACLS from generating complete accurate measurement and attaining its purpose are:

The human resource base. Lack of trained personnel and dedicated staff committed to agriculture data collection task. Field officers who are into Agricultural data collection (MRACLS) operation only undertake data collection as a secondary activity because their primary responsibility is for extension duties. The combination of the two activities is difficult because, not only does it affect the time for the survey activities but equally it can skew the information being provided in the following direction. The holders engage in the interviews by the extension officers are most likely to received more information or guidance than holders in other enumeration areas who are not involve in the survey and therefore receive fewer visits, this make them not a good representative of holders in the districts, (ifpri.org).

The extension officers who participate in the agriculture data collection may bias the responses from the holders because they are not impartial individuals in the agricultural production process.

Resource to implement: Inadequate logistical and travel support in terms of funding. Data collection activities receives minimal attention in the current decentralized district offices because of limited resources for these important activities.

The equipment: The non -availability of equipment to staff, the supplies needed to adequately perform survey task ,like the basic needs such as measuring tapes, pencil, and calculators to more advanced devices like GPS devices and tablets or computers and their accessories.

The management of data and quality control: Inadequate software devoted and processes or procedures for inputting, processing, analysis and disseminating quality data.

Also an evaluation of the two systems ACS and MRACLS confirms that they have several similarities both in design and the field operation instruments but differ in both frequency and time dimensions. It is suggested that similar institutional challenges that have undermine the MRACLS are likely to be plagued by the ASC if it is not completely funded and well managed. As a result, it is wise to say that the two parallel institutional challenges affecting the ASC and MRACLS be tackle to guarantee the survival of up-coming agriculture data collection schemes.

Again, it is further suggested that one well-funded designed and executed agriculture survey would be sufficient to satisfy the need of the local and national policy makers, planner and researchers. If it was to be carried out annually, considering the comparable manner in which their questionnaire to generate data addressing similar topics. Alternatively, if the MRACLS were working as it was intended the country already would in effect have annual agriculture sample census and there would be no need for a decennial ASC. The following dimensions would still require special attention so as to guarantee the agriculture statistics system satisfies the demand of stakeholder even if the MRACLS implemented as plan.

Districts level Representatives and sample size: The MRACLS sample design was originally completely considered to generate approximate statistics for districts. The initial sample strategy was to collect data from 20 agriculture holders per district, but as mentioned earlier, the process has been changed in a manner that decreased the sample size levels to a stage where only 10 holders were interviewed in 10 enumerated areas in each district which sum to 100 observations for each district. This sample size is not adequate enough to produce precise district level statistics. Normally, a sample size of 400 holders should be interviewed in every district, (all 176 districts) which gives a total of 70,400 holders. Such a sample will generate districts estimates with 5 percent margin units for major indicators like percentage of holders cultivating a given crop or using an input.

Data management and measurement precision: The incorporation of latest technologies such that the application of GPS for field area measurement and geo-referencing holders location, the use of computer assisted field edits (CATE) system for data collection, which gives the chance to see and correct errors while still on the field.

Raw Household Data Dissemination as against aggregated statistics: The fact that this has already been talked off, it deserved an additional attention because it is important to the success of any agriculture statistical system. The dissemination of raw data will help all stakeholders of agriculture statistics to be well informed about agriculture in Ghana and to assess the quality of the data. Equally, limiting data dissemination to aggregate statistics restrict its worth, usability and credibility of information collected.

Feedback loop at the District level: The generation of indicators and descriptive statistics directly useful for making policies and monitoring at the decentralized level at the right time. This is important to encourage greater gratitude and the use of data that is generated. This will motivate the production of quality data in the future.

The breadth and depth of the MRACLS data collected would be significantly improved by the fielding of the entire questionnaire or instrument as originally plane. Despite all that are mention, there are a number ways that could be improve to better serve the interest of stakeholders in monitoring, evaluation and research. Although it does not constitute an exhaustive set of recommendation, the following list is example of some important improvement that can be made, (ifpri.org).

The implementation of the change, would enable stakeholders to have a more deeper and complete understanding of agriculture dynamics in Ghana , especially it will lead to more clear and direct evaluation of how different factors affects agricultural activities, like the use of inputs the choice of crops, ownership of assets, market, access to information and production among others. Module on the questionnaire should include:

Pattern on tenure and land use: Land access, tenure either rented, share cropped, household or community owned, individual customary or individual stationary, shared, squatted and so on.

Farm or plot-wise information on the use of farm inputs: seeds, organic and inorganic fertilizers, pesticide and herbicides, equipment use and ownership labor including wages as well as the sources of credit terms and uses.

Farm or plot-wise information on farm outputs. Prices and quantities sold, consumed and production stored or reserved as well as place or sales for several list of livestock, horticulture, trees crops, field crops and aquaculture.

Agricultural goods processed like milk, milled grains, canned produce, honey and many others.

Information on demography: Detailed education information, nationality, language, ethnicity and literacy which are key indication of human capital. And also thoroughly coded information of primary and secondary occupations standards classification of occupation. ISCO-08.

Ownership or Household assets and information on dwelling which are reliable proxies for holder's welfare. Furthermore, the role of women in Ghanaian agriculture needs to be given special attention in order to measure their contribution to the natural agriculture production. In order to ensure that the issue of gender is adequately assessed, careful consideration of their agricultural responsibility and how to better assess the underlying issues and application of their participation are required, (ifpri.org).

### **2.8.2 Strategy Proposed**

The following were suggested to assist MOFA in supporting its establishment of MRACLS in order to satisfy agricultural statistics requirements of planners and researches in Ghana.

Assisting MOFA in establishing MRACLS upon good practice, piloting and updated version of the current MRACLS called the Ghana Agricultural Production survey (GAPS) is proposed.

The Ghana Agricultural Production Survey intention is to try the following main enhancement to be affected in the MRACLS so as to empower agricultural statistics systems in Ghana.

Updated and disaggregated sample design of districts representativeness.

Increase coverage and in-depth, geo-referenced agricultural information gathered.

Modified and improve system of management making of enhance data management processes and software for enhanced and timely processing, assessment and documentation.

In attempts to solve these problems, GAP will generate agricultural statistics of improved quality and of national representativeness in the immediate term from the selection of districts.

Build the capacity for improving MRACLS data collection in the future.

Offer the opportunity for up scaling to provide high quality data of national representativeness in the future.

Serve as a pilot to the Agriculture sample census, if its implementation is also slowed down, (ifpri.org).

### **2.9.1 The Ghana Census of Agriculture**

This census of Agriculture (CA) is a broad statistical operation that collects, processes and also disseminates information concerning the dynamics of agriculture in Ghana. Other information can also be collect from communities; mainly on geography, socioeconomic conditions, infrastructure, and availability of agricultural and social services, potentials and constraints for development. It is part of the development of an integrated approach to producing statistics for food and agriculture of a country, as recommended by the United Nation (UN) Food and Agricultural (FAO) World Census of Agriculture (WCA) Program, (Census of Agriculture 2016-019 Field Manual).

The general purpose of the CA is to support poverty alleviation by ensuring the security of food through more effective policies and strategies on the basis of reliable, relevant and timely structural agricultural statistics and a set-up of an agricultural information system that can stimulate the growth of the agricultural sector and revitalize the rural economy. The aim is to improve the production and dissemination of statistics on food and agriculture to meet the data requirements for monitoring programs developed under Ghana's, the Ghana Shared Growth Development Strategy (GSGDS), Medium Term Agriculture Sector Investment Plan (METASIP), Food and Agriculture Sector Development Policy (FASDEP), and the Millennium Development Goals (MDGs), (Census of Agriculture 2016-019 Field Manual).

Specifically, it is to strengthen the National Agricultural Statistics System and improve the availability of statistics on the rural sector and also the information to be used as basis for the establishment of an Integrated Permanent System of Agricultural Statistics (IPSAS). To realize the above stated objectives the Agriculture census is organized by the use of some modular procedures which comprises of: Main (Core) and Community modules, Supplementary (comprehensive) modules; and a thematic module (surveys of areas of interest), (Census of Agriculture 2016-019 Field Manual).

### **2.9.2 Outcomes and outputs**

The Government is committed to carrying out the CA and the focus is on the following main aspects:

Technical and administrative preparation of the CA.

Launching and monitoring of data collection operations of the CA.

Data processing of the CA: coding, data entry, cleaning of files and tabulation.

Selection of priority themes for analysis of CA data.

Strengthening technical and operational capacities.

Publication of final results of CA.

Organization of national seminars to disseminate the results of the CA.

Dissemination of results through Country STAT web site.

All users will have detailed data on the Ghanaian rural sector so that they will be able to make informed decisions. Partial knowledge and sometimes rough estimates cannot be used to make useful and informed decisions. The CA will thus provide complete and more reliable information to allow policy makers to better identify, prepare, implement and evaluate development projects, as well as develop better strategies for the development of the agricultural and rural sector, and to estimate national accounts of the agricultural sector on sound basis.

The Census of Agriculture also provides information for the consideration of environmental aspects in development programs and projects especially at basic or community level (intensity of different types of land use, interactions between climatic phenomenon and crop and livestock production, agro-forestry, etc.), (Census of Agriculture 2016-019 Field Manual).

### **2.9.3 Implementation of Census of Agriculture**

The Ghana Census of Agriculture is conducted according to recommendation of FAO as contained in its World Census of Agriculture 2020 Modular Approach Program. This approach was initiated to help countries meet the increasing demand for agricultural information by providing broad range of information from the Census of Agriculture, whilst cutting down operation cost. The main features of the approach, as indicated earlier, include a Core, Supplementary (comprehensive) and Thematic modules. The modular approach implemented in four Phases. Phase I involves the preparation of technical and administrative documents, was started in October , In Phase II the Core and community modules is implemented by completely enumerating all households with special focus on agricultural households. Comprehensive Modules on crops and livestock, which are part of Phase III, is executed using large samples to ensure district level estimates. Similarly, the Thematic Modules, which are also part of Phase III, conducted using samples and run concurrently with the Comprehensive Module. Phase IV involves the finalization of technical reports for all modules and dissemination. The Core Module of CA is implemented together with a Community Module to collect community level data, (Census of Agriculture 2016-019 Field Manual).

#### **The Core Module**

The Core Module consists of complete enumeration of households and focuses on a limited number of topics that provide sampling frames for Supplementary and the Thematic Modules and also benchmark data. It also provide key data on the structure of agriculture including land tenure types size of farms, livestock numbers, equipment use and technology on holdings among others, (Census of Agriculture 2016-019 Field Manual).

### **Collection of community data**

In a CA, information on aspects of communities are necessary and important for planning at the decentralized level, identification of poor areas for improvement programs besides for relief in the event of natural disasters. The areas identified by the community survey are grouped into four broad categories mainly focused on Geography, community infrastructure and services and situation on socio-economics and also developmental programs.

The Community Module is done alongside the Core Module Questionnaire to collect information on infrastructure, socio-economic conditions, availability of basic facilities, potential for development and constraint and availability of community services among others. This is to enable the government to know the levels of development especially in the rural areas in order to design programs towards the further development of these areas, (Census of Agriculture 2016-019 Field Manual).

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.0 Introduction**

This chapter discusses the series of steps that were followed in collection of the relevant data for the study. Specific parts covered were, The research design, Study Area, Study population, Sample size and sampling Techniques, Data collection method, Data collection instrument, Pretesting of the instrument, Validity and Reliability of data, Data processing and Analysis, Delimitation, and Ethical consideration as shown below,

Diagrammatic Representation of the steps used in the Methodology

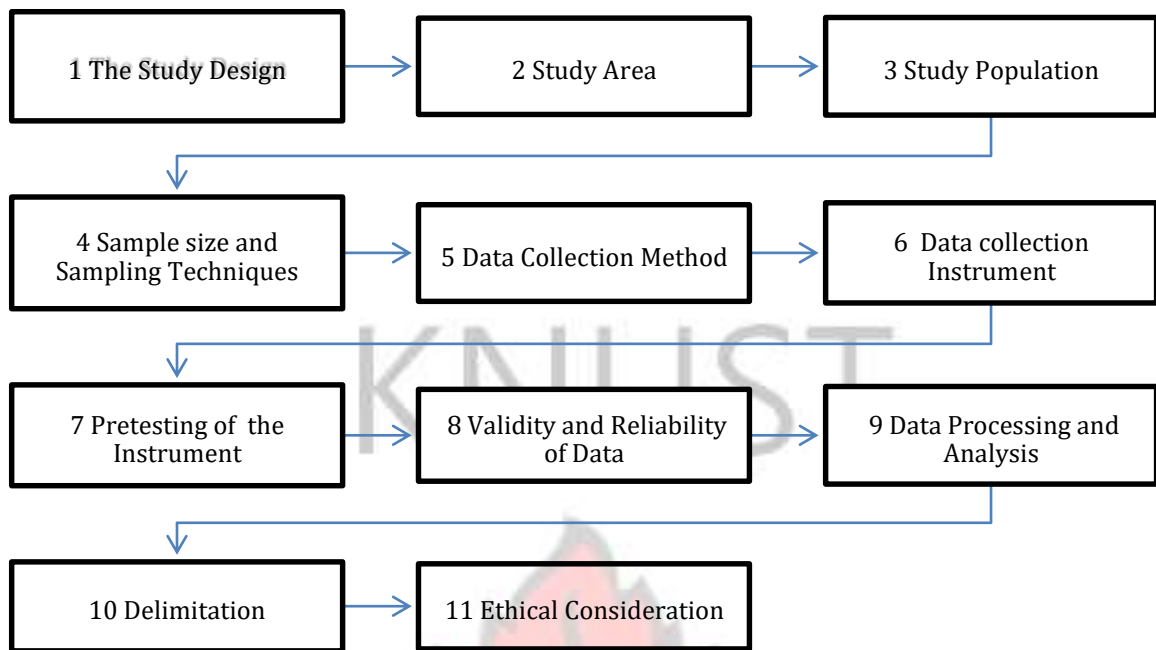


Figure 3.1 Diagram showing the various Steps involved in the Methodology

### 3.1 The Research Design

(As stated by koul (2002)), a research design describes the various decisions which are involve in the gathering of the necessary data. The plan thus make the structure for the assembling, quantification and the analysis of data. Fink (2002) defines research design as every processes and steps taken in contacting the respondents.

The study design used for this study was a descriptive survey. A descriptive survey involves the collection of data to answer question on the current state of the topic of enquiry. It tries to reveal and reports the way things are. ((Gay, 1992); ( Babbie, 1990)) points out clearly that descriptive surveys are very useful for making generalization from a given sample to an entire population such that conclusion can be made about the behavior of the population. A descriptive research involve asking several

individuals the same set of questions either through mail, Email, telephone or face to face interview.

(Cresswell, (2002)) and (Koul, (2002)) points out the advantages of a descriptive research, they hold the view that it offers a more comprehensive representation of events and tries to describe perceptions with the use of data collected at a point in time. Some advantages of descriptive surveys are economy of the design and the rapid turn round in data collection.

(Payne and Payne, (2005)) held a contrary view, claims that in making use of descriptive survey, there is the problem of guaranteeing that the questions to ask are clear and not misinforming. However, steps have been taken by the researcher to minimize these weakness associated with descriptive surveys.

### 3.2 Study Area

Ghana's Agriculture is mostly practiced as a family operation or business, dominated by small holder farmers with the use of simple equipment to produce about Eighty percent of the country's total Agriculture output. By estimation, about 2.7 million Ghanaian households rare some livestock or own a farm. From the recent population and Housing census, about 50 percent of the labor force or 4.2 million Ghanaians are involve in agriculture. Most of the farms holdings work on less than two hectares of farm land, (Ghana Statistical Service 2013).

The study was carried out in eighteen (18) districts across Ghana as shown in Table 3.1 below.

Table 3.1 The study districts and their Population

District name	Capital Town	Total population	Male population	Female population
<b>Adansi North</b>	Fomena	107,091	53,055	54,036
<b>Ejura Sekyere</b>	Ejura	85,446	42,892	42,554
<b>Offinso North</b>	Akomadan	56,881	28,300	28,581
<b>Asunafo North</b>	Goaso	124,685	62,854	61831

<b>Techiman Municipal</b>	Techiman	147,788	71,732	76,056
<b>Mfantseman Municipal</b>	Saltpond	144,332	64,923	79,409
<b>Assin North Municipal</b>	Assin Fosu	161,341	80,254	81,087
<b>Atiwa District</b>	Kwabeng	110,662	54,671	55,951
<b>Kwahu South</b>	Mpreaso	69,757	33,094	36,663
<b>Ga East Municipal</b>	Abokobi	147,742	72,987	74,755
<b>Central Gonja</b>	Buipe	87,877	43,860	44,017
<b>Kpandai</b>	Kpandai	108,816	54,997	53,819
<b>Bongo</b>	Bongo	84,545	40,084	44,461
<b>Nadowli Kaleo</b>	Nadowli	61,561	28,753	32,808
<b>Bia West</b>	Essam	88,939	45,717	43,222
<b>Jomoro</b>	Half Assini	150,107	73,561	76,546
<b>Keta Municipal</b>	Keta	147,618	68,556	79,062
<b>North Dayi</b>	Anfoega	39,913	18,649	21,264

Source: Ghana population and Housing Census, 2010

The Visualization of Population Distribution in the study Districts and Ghana Map Indicating the Locations of the eighteen (18) study Districts are Shown in Figures 3.1 and 3.2 respectively

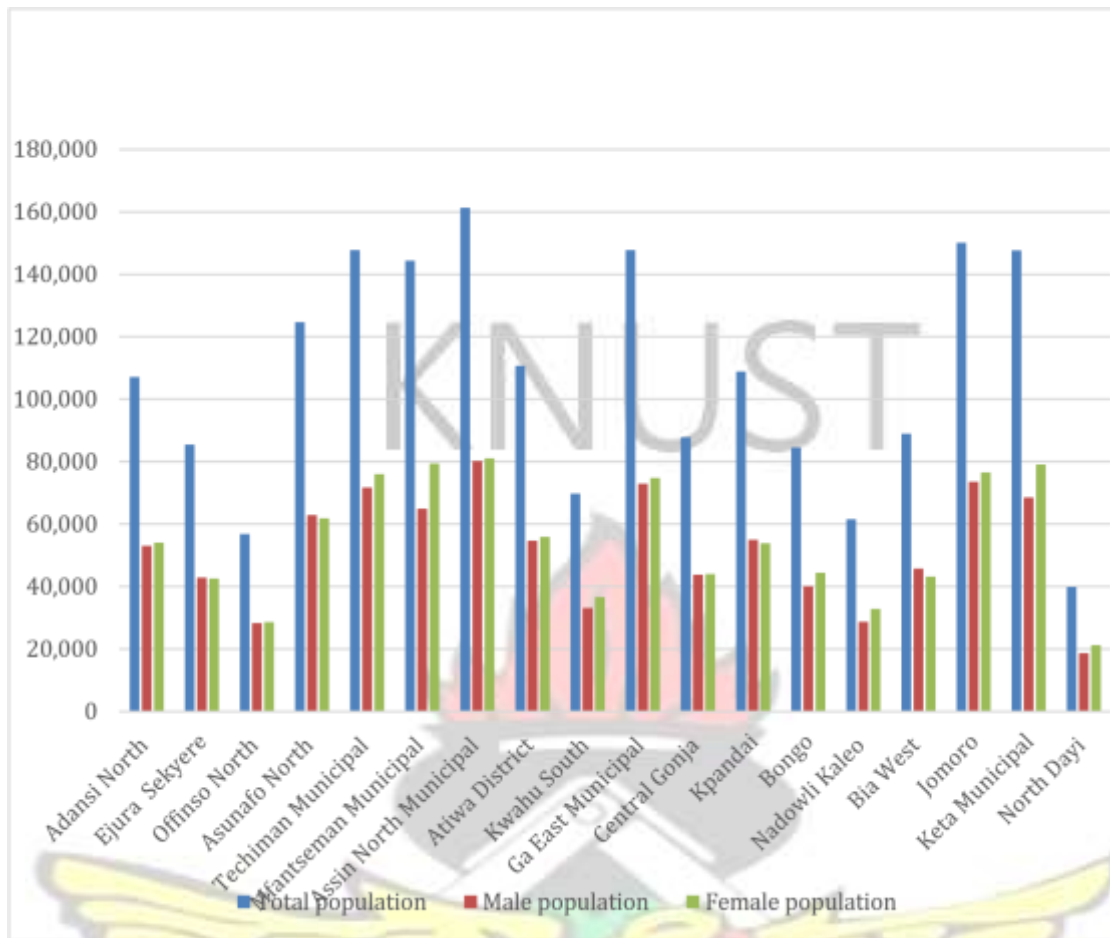
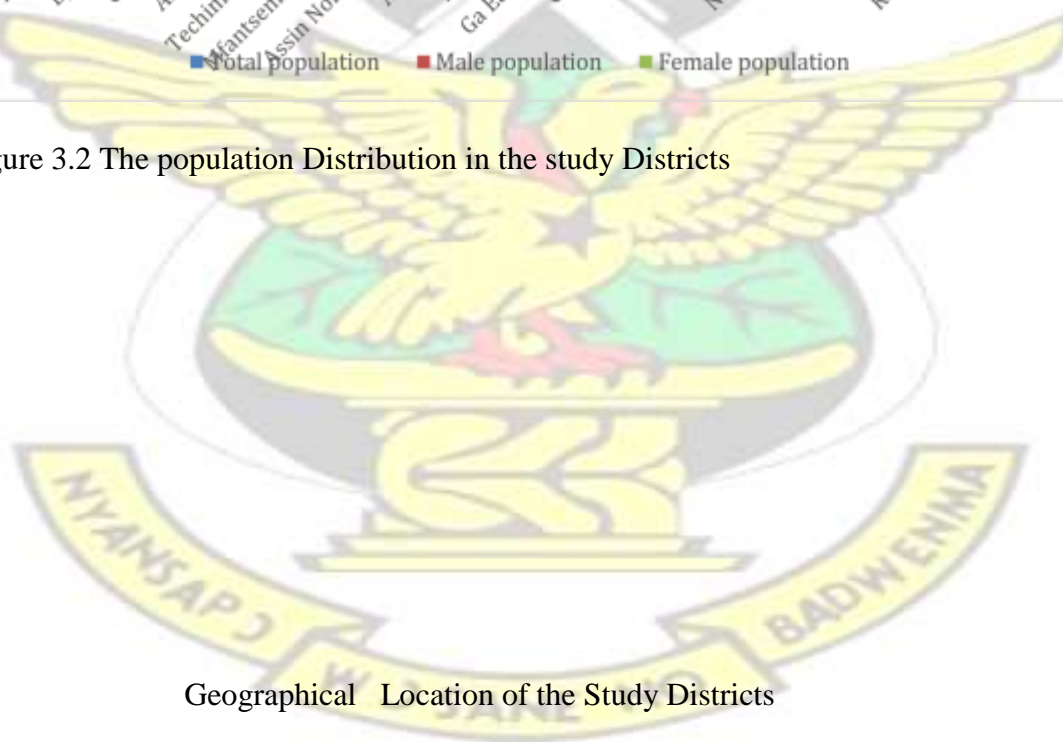


Figure 3.2 The population Distribution in the study Districts

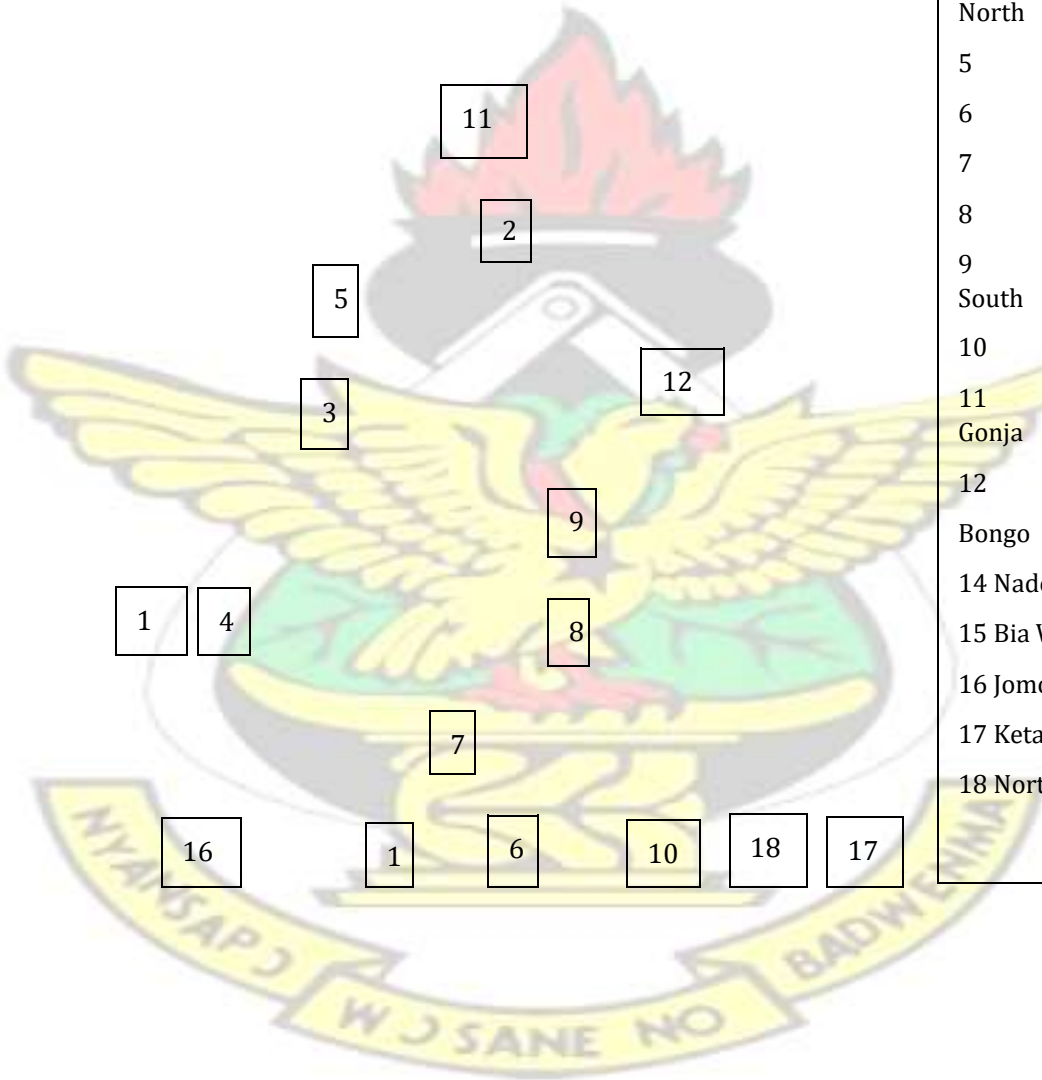


Geographical Location of the Study Districts

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13

# KNUST



## KEY

- 1 Adansi North
- 2 Ejura Sekyere
- 3 Offinso North
- 4 Asunafo North
- 5 Techiman
- 6 Mfantseman
- 7 Assin North
- 8 Atiwa
- 9 Kwahu South
- 10 Ga East
- 11 Central Gonja
- 12 Kpandai 13 Bongo
- 14 Nadowli
- 15 Bia West
- 16 Jomoro
- 17 Keta
- 18 North Dayi

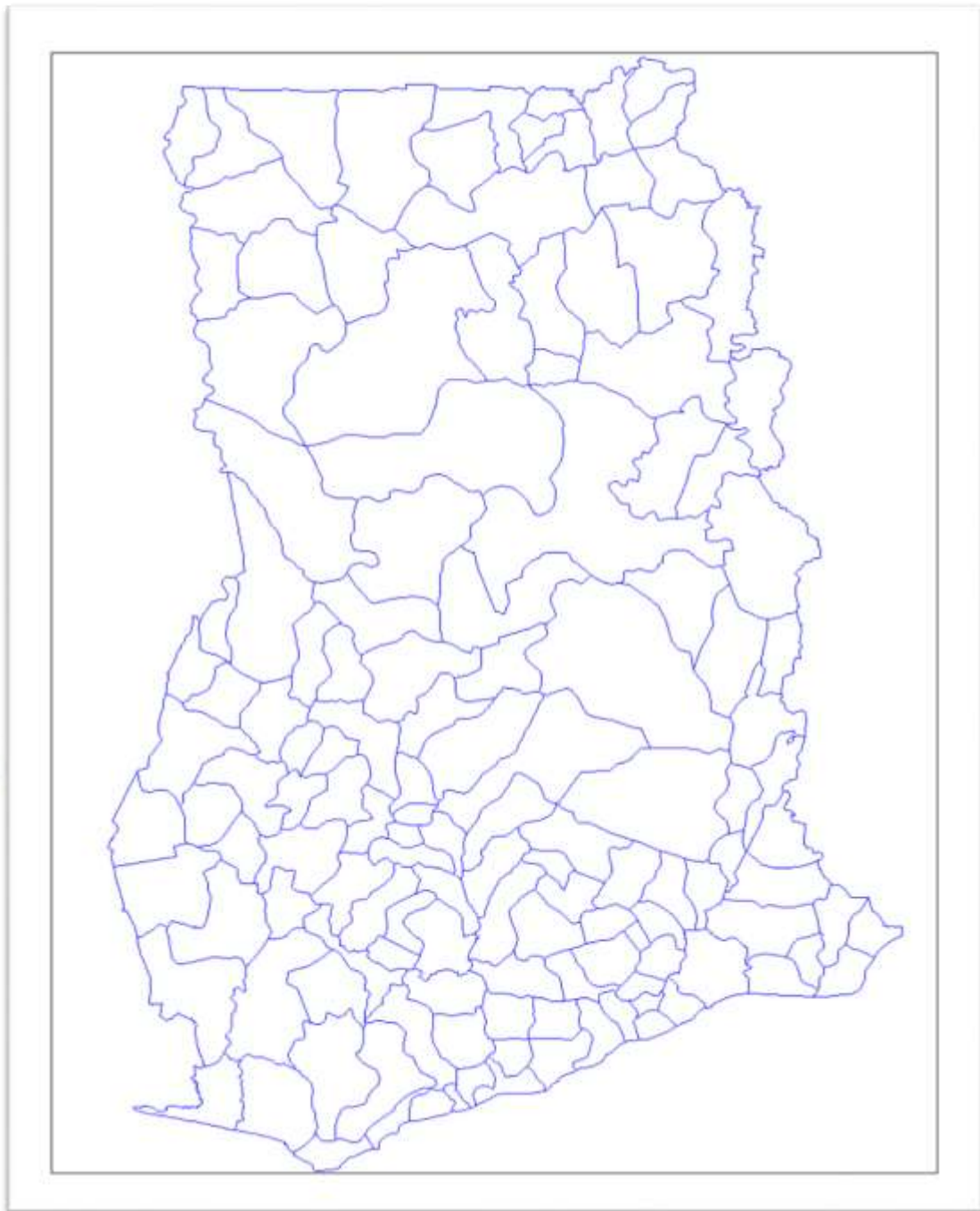
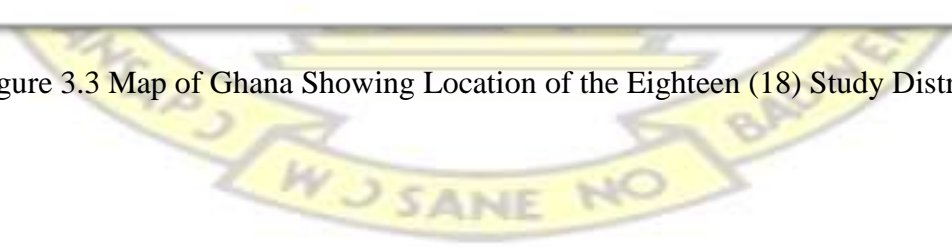


Figure 3.3 Map of Ghana Showing Location of the Eighteen (18) Study Districts



### **3.2.1 The profile of the Districts used for the study**

The profile of the Eighteen (18) sampled Districts and municipalities based on the following: location, size, climate, vegetation and Agriculture described below, (ghanadistricts.gov.gh).

#### **3.2.1A Adansi North District**

##### **I Location and Size**

The Adansi North District falls within a tropical region of Africa and Located on Longitude 1.50 W and Latitude 6.30 N. The district experiences high rainfall and temperatures throughout the year and it is characterized by a Semi-Equatorial climate. The districts covers an area of approximately 1140 square kilometers being around 4.7 percent of the total land area of the Ashanti Region of Ghana.

##### **II Climate and Vegetation**

The mean annual temperature is about 27 degrees Celsius. Temperature are generally high throughout the year with mean monthly temperature ranging between 26 to 30 degrees Celsius. The district experience semi-equatorial climate conditions. The rainfall is double maximum with annual total rainfall ranging between 1250 mm to 1750 mm. The major rainy season is from April to July and minor rainfall comes between September and December. The vegetation is that of the semi deciduous type. This type of vegetation is characteristically comprises of three different layers called the under growth, the middle, and upper layer. The vegetation support the growth of several types of trees both big and tall which are in mixed stand and are also soft and hard wood. Some example are Wawa, Odum, Mahogany, Sapele and Amira.

##### **III Agricultural Sector**

Agriculture is the major occupation of the people in the district and employs around 77 percent of the labor force in the district. The male and female population who are active and engage in farming activities stand at 55percent males and 45percent females. There is therefore no distinction between farming involve in to cash crops and food crops or those in to crops production and livestock rearing like sheep, goats, cattle and poultry. With regards to agriculture extension works, there are seventeen (17) areas of operation, there is one extension officer in each operation area. The four main types of land

acquisition in the district are Individuals family abumu or abusua and outright purchase. The typical farm size in the district is around 5 acres. Food crops like maize, yam, plantain, cassava, cocoyam and vegetables are mostly produced. The production of cash crops like cocoa, oil palm and citrus are common.

### **3.2.1B EJura - Sekyere Dumasi Municipal**

#### **I Location and Size**

Ejura is the administrative capital and was established by Legislative Instrument (L.I) 2008. The municipality is situated in the Northern part of Ashanti Region and bounded in the South by Sekyere West and Afigya Skyere districts, on the East by Sekyere East district on the West by Offinso district and on the North by Atebubu and Nkoranza districts (both in the Brong-Ahafo Region) . It occupies about 7.3 percent of the total land area of the Ashanti Region. According to the 2010 population and Housing Census, the municipality has a population of about 85,446 with 42,892 males and 42,554 females, (ghanadistricts.gov.gh).

#### **II Climate and Vegetation.**

The municipality lies between the Guinea Savannah Zone and the transitional Zone of the Semi Deciduous forest. The Area experiences two types of rainfall patterns; the unimodal in the North and the bimodal in the south. The major rainy season is between April and November. The North East Trade wind (Harmattan) blows dust and dry winds across the period. The annual rainfall varies between 1200mm and 1500 mm. The northern part is covered with sparse derived deciduous vegetation. The growth of savanna type of vegetation contributes to the increase in the rate of farming like bush fallow or shifting cultivation. The vegetation is characterized by the type of topography. Cereal production in the North is supported by the derived type of savannah. The climate condition of the districts favors the cultivation of food crops due to the fine topographical layout.

#### **III Agricultural Sector**

As a typical characteristic of a Ghanaian setting, Agriculture sector dominates all the other sectors with regards to employment. It engages about 68 percent of the population which is more than the country's rate of 60 percent. Agriculture is the main stay of the

people in the municipality. It is the main form of livelihood for most people in the district. The Agriculture activities include livestock rearing and the growing of food and cash crops. The common type of farming systems are mixed cropping, mono cropping and mixed farming. The production of different crops in the district due to the engagement of mono cropping and mixed cropping. Some crops are grown mainly for consumption but the surplus is sold. Crops like beans and water melon are mainly for sale.

The district has 19 agriculture operation areas and each operation area has several communities and is taken charge by one extension officer. Mechanized farming systems is normally practiced which enhance farming activities especially with maize production which is supported by rich arable land suitable for maize production.

Agriculture in the district also involves the rearing of livestock and raising of other farm animals. The farm animal may include ruminants like sheep, goats, cattle and others. Animal rearing is another source of livelihood for the farmers in terms of food and income. The production of livestock does not need much skill and resource as compared to crop production. The crops benefits from the droppings of the livestock in the form of manure whereas crop residue is used as feed for livestock. Sheep and poultry are the common livestock reared in the district.

### **3.2.1 C Offinso North District**

#### **I Location and Size**

The Offinso North district share boundaries with the Sunyani Municipal Assembly in the West, Techiman Municipal Assembly in the North, Offinso Municipal Assembly in the East. The district lies between longitude 10.60 W and 10.45 E and latitude 70.20 N and 60.50S. Total land area of the district is about 741 square kilometers.

#### **II Climate and Vegetation.**

The district lies in the semi-equatorial climate zone and experiences double maxima type of rainfall, the major season is from April to June and the second or minor from September to October. The annual rainfall ranges between 125.0mm and 180 mm. The pronounced dry season experience in the district occurs in November to March. The relative humidity is usually high ranging between 75-80 percent in the rainy season and

70-72 percent in the dry season. The highest temperature of 30 degrees is experienced between March and April. The district is located in the most semi-deciduous forest zone interspersed with thick vegetation cover. But there is a vast emergence of Guinea savannah in areas like Akumadan, Afrancho etc. The common three species in the reserves are ceiba, wawa, cassia, mahogany and odum.

### III Agricultural Sector

The main economic activity in the district is agriculture. More than 80 percent of the people in the district are engaged in agriculture from which about a quarter being the youth. Livestock and poultry rearing are mostly on free range and of limited numbers including fishing. The major crops grown are cocoa, cashew, maize, cassava, plantain, yam and vegetables. The only Irrigation scheme at Akomadan has a potential of cultivable area of about 1000 hectares. It is used for vegetables and rice cultivation by people of the surrounding communities, ([ghanadistricts.gov.gh](http://ghanadistricts.gov.gh)).

Cocoa production is concentrated in areas like Sosoko, Akrofoa, Tanakwaem, Nkenkenu and Akumadan with low production levels. Oil Palm production is estimated to be about 1200 hectares and thus lucrative and is getting a good patronage. Citrus takes about 400 hectares. Farming in the inland Savannah is facing serious problems and farmers are advised to concentrate on oil palm production. About 800 hectares is being estimated to be used in cashew production which is mostly in Nsenoa area.

Livestock rearing is mostly on free range especially with the small ruminants. The production of cattle could however be said to be semi intensive. Farmers receive veterinary service from the District Directorate. Agriculture extension services are made available to farmers in the district, but of late it had serious challenges. Palm oil, palm kernel and Gari processing are some of the Agro-processing activities in the district.

### **3.2.1D Asunafo North Municipal**

#### I Location and Size

The municipal is located between longitude 2.52 degrees W and Latitude 6.27 degrees

N. The total land area of the Asunafo North municipality is about 1093.7 square kilometer with 389.7 being forest reserve. The municipality share boundaries with Juaboso -Bia and sefwi-Wiaso District in the North East. Dormaa municipality on the North West and Asunafo South Municipality in the Brong Ahafo Region on the south Western borders.

## II Climate and Vegetation

The Wet-Semi equatorial type of climate is experience in the municipality. Temperature are generally high throughout the year with March being the hottest month and a 30 degrees the higher ever recorded. The double maxima rainfall pattern is experienced in the municipality with mean annual rainfall ranging between 125 cm and 175 cm. The major rainy season normally last from April to July and minor season from September to November. The municipal also experiences a prolong dry season from December to March and a short dry spell in August. Major cropping activities begins with the onset of the rains. the vegetation of the forest with different types of trees species like Aprozuma, Emire, Oyina/ceiba, Kyenkyen, Dahoma, Kusa, Sapele and odum. Which are highly used as timber.

## III Agricultural Sector.

Agriculture is the major activity in the municipality and engages almost 64 percent of the economic active population. Most households are into agriculture as a means of livelihood which are on small scale bases, with average farm size being about 5 acres for most crops. Much of the agriculture in the municipality is under used despite its importance in the economy of the area. The major crops found in the area are Cocoa, Oil Palm, Plantain, Cassava and vegetables. The municipality has four agro processing plants sited in different parts of the Assembly. Oil palm at Kasipin, Gari and cassava flour at Wam and the distillation of local gin, akpeteshi at Asuodai.

Livestock rearing is not a major activity in the area, only few farmers keep goats, sheep, and pigs with a small number of poultry farmers on commercial scale. However, most household keep few fowls on free range. Both livestock and crops production are affected because of inadequate extension services received by the farmers. The common farming practice is mixed cropping with few plantation like cocoa and oil palm.

### **3.2.1E Techiman Municipal**

#### **I Location and Size**

The Municipality is situated in the central part of the Brong-Ahafo Region of Ghana. It is one of the twenty-seven districts/Municipalities in the Region and lies between longitudes 10.49 East and 20.30 West and latitude 80.00 degrees north and 70.35 degrees south. The municipality share common boundaries with Wenchi, Techiman North and Nkoranza in the Brong-Ahafo region and Oofinso North district in the Ashanti Region. The municipality has a total land size of about 649, 0714 square Kilometers with a population density of 277.7 persons per square kilometer. The population of the municipality according to the 2010 Population and Housing Census stand at 147,780 with 71723 males and 76056 females.

#### **II Climate and Vegetation**

The municipal experiences both tropical conventional and savannah and semiequatorial climate with moderate to heavy rainfall. The major season begins in April and ends in July while the minor last from September to October. The mean annual rainfall is between 1660 mm and 1260 mm. The pronounced dry season in the savannah zone occurs in November to March. The highest average monthly temperature ever recorded is about 300 degrees celcius (860 F). The relative humid is always high all year round.

The three main vegetation zones are semi - deciduous zone in the South, Guinea Savannah woodland in the North-west, and the Transitional zone which stretches from the south-East and West up to North of the municipality. Due to human activities such as logging and charcoal burning the Semi-deciduous forest has lost most of its green vegetation and the municipality is deprived of its valuable forest resources.

#### **III Agricultural Sector**

The municipality is known for its agriculture activities due to the fertile lands particularly in the southern part which has attracted migrant farmers from northern Ghana. Although the south is considered to have fertile lands. Agriculture extension services is concentrated in the North than South. But access to Agricultural information in the south is supported by the presences of Agricultural Directorate located in the municipality capital Techiman.

### **3.2.1F Mfantseman Municipal**

#### **I Location and Size**

The municipality is located along the coastline of the Atlantic in the central part of Ghana. It stretches approximately around 13 kilometer in land and 21 kilometers along the coast line covering about 300square kilometers in area. It occupies about 3 percent of the regional land area. The administrative capital of Mfantseman is Saltpond. The municipality shares common boundaries with Abura-Asebu-Kwamankese district in the West, Ekumfie Districts in East, Ajumako-Eyan-Essiam district in the North East and on the south by Atlantic Ocean (Gulf of Guinea). It extends from Mankessim (the most Eastern part) to Eguase (the most Western Part).

#### **II Climate and Vegetation**

It has mild temperature, ranging between 240 and 280 degrees celcius because of proximity to the Atlantic Ocean. It vegetation is made up of grass and dense scrub tangle. Around fetish grooves and isolated area are found rockets of relatively dense forest.

#### **III Agricultural Sector**

The main economic activities in the municipality are fishing and Farming. Over 70 percent of the labor force are engaged in agriculture and Fishing. Fishing is done especially in the inland areas and crops grown include oil palm, cocoa, citrus, pineapples, plantain and cassava.

### **3.2.1G Assin North Municipal**

#### **I Location and Size**

The municipal lies within longitude 1.05 East and 1.25 West and latitudes 6.05 North and 6.40 south. It is one of the twenty (20) districts in the central Region of Ghana. Assin North is bounded to the south by Assin South districts, Twifo Hemang lower Denkyira to the west, Ajumako Enyan - Esiam and Asikuma. Odoben - Brakwa on the East. Upper Denkyira East municipality to the North-west and Ashanti Region to the

north. The municipality comprises of around 1000 settlements with Assin Fosu being capital and covers an area of about 1520 square kilometers.

## II Climate and Vegetation

The vegetation of the municipality is generally deciduous forest. The area experience an annual precipitation between 1500 mm and 2000 mm. Temperatures are generally high ranging from 30 degrees celcius from March to April and about 26 degrees celcius in August. Relative humidity is high ranging from 60 percent to 70 percent. This condition allows for the cultivation of food, cash and some non -traditional expert crops. The area experiences relatively cool and moist south-west monsoon winds that blows from the Atlantic for most month of the year. But the North-east Trade winds or Harmattan blows from the North. However, its effects is reduced by the long passage over the forest zone. The double maxima rainfall is experienced in the area with the major season lasting from April to July when most crops are planted and the minor rainy season lasting between Septembers to November.

## III Agricultural Sector

The major economic activities in the municipality are crops cultivation and livestock rearing and this engages about 60 percent of the total labor force due to the prevailing favorable climatic conditions and relatively good vegetation, crops cultivation is mostly practiced as compared to the rearing of livestock which alone accounts for about 57 percent of total agriculture sector contribution to employment. Crops of economic importance includes plantain, cassava, cocoyam, citrus, oil palm and cocoa.

The average farm size is about 4 hectares with about 61 percent of farm holdings having more than 3.7 hectares which is relatively higher than the national average of 3.0 hectares for small scale farmers. The production of crops has not been given much attention leading to low production. Food crops production is mostly under subsistence farming with relatively small quantity for sale. Most farmers still use the traditional method of slash and burn. The practice of cultivating permanent crops like cocoa, oil palm and citrus as given much pressure of land acquisition. Therefore, there exists limited land for staple food crops.

### **3.2.1H Atiwa District**

#### **I Location and Size**

This district is one of the twenty one districts in the Eastern Region of Ghana and cover a total land area of about 2950 square kilometers. The district lies between longitude 0.3 W and 0.50 E and latitude 6.10 N and 6.30 N. The district share common boundaries with, Birim North to the West, Kwaebibnm to the south, East Akim to the south -East on and North-East by the Fan teakwa and kwacha West and kwacha south to the North. The estimated population of the districts from 2010 population census is 110622.

#### **II Climate and Vegetation.**

The district lies within the semi-deciduous forest and has two rainfall patterns with annual rainfall ranging from 1250 mm to 1750 mm. The atmospheric temperature is thereby uniform all year round ranging between 26 to 36 degree celcius.

#### **III Agricultural Sector**

Agriculture employs about 60 percent of the total labor force. These are catered for by fifteen agriculture Extension officers. Majority of the settlements within the district are engage in agricultural activities apart from few urban centers. The major crops grown in the district are cocoa, maize, cassava, plantain, oil palm and vegetables. The major cash crops are cocoa and oil palm. Slash and burn and mixed cropping are the types of farming practices practiced in the district. Cocoa is the most important crop in the district.

### **3.2.1I Kwahu South District**

#### **I Location and size**

This district is one of the twenty six (26) districts in the Eastern Region of Ghana. The district covers 1462 square Kilometers of land area and lies between longitude 0.30 degrees W to 1 degrees W and latitude 6.30 degrees N and 7 degrees N. It has common boundaries with kwacha west to the South, Kwahu East to the North, Fanteakwa to the East and Asante Akim South to the West.

## II Climate and Vegetation

The weather condition in the district is generally cold with annual mean temperature of 24.0 degrees celcius which is experienced between March and April with the minimum temperature of 20.0 degrees celcius in August. The area is located in the climate region of semi-equatorial and has the double maxima rainfall in a year. With mean rainfall ranging between 125cm and 200cm. The major rainy season starts from May and ends in June with heaviest mostly in June whereas the minor or second rainy season begins in September and ends in October. This district which lies within the semi-deciduous forest.

## III Agriculture Sector

Agriculture sector employs about 50 percent of the active population in the district and is predominantly on subsistence agricultural. Crops mostly grown by farmer in the district include food crops like maize, cassava, plantain, groundnut and cocoyam and cash crops like cocoa, oil palm, citrus, cola, coffee and vegetables. The major livestock and poultry reared also include goats, sheep, cattle, pigs, turkey, guinea fowl and grass-cutters. Along the Afram River some local farmers are also engaged in fishing. There is irrigation farming but of limited number of farms.

### 3.2.1J Ga East Municipal

#### I Location and size

The Municipal is sited at the northern part of the Greater Accra Region, Abokobi is the administrative capital. The assembly has common boundaries with La-NkwantanangMadina to the East, Adenta Municipal to the South, Ga West Municipal to the West and Akuapim South Municipal to the North. According to the 2010 Population and Housing census, the population of the Municipality stood at 147,742 with 74,755 females and 72,987 males.

#### II Climate and Vegetation

Ga East Municipal lies within the savannah agro-ecological zone, it experience double maxima rainfall pattern, with mean annual temperature from 25.1c<sup>0</sup> in August to 28.4c<sup>0</sup> in February and March. The highest temperatures are normally recorded in February and March. The two main vegetation in the municipality are grassland and shrub land.

The grassland which has been encroached upon by human activities such as settlement is found at the southern part of the district, while the shrub lands are commonly in the western suburbs and in the north towards the Aburi mountains, consist of dense cluster short and small trees with average height of about five meters.

### III Agricultural sector

The main agricultural operation undertaken in the municipality are livestock and crop production, which employs about 55 percent of the labour force in the municipality. The variety of vegetables produced includes, okro, garden eggs, cabbage, tomatoes and hot pepper. The production of livestock includes small number of cattle, turkey and poultry on a more large scale. Also, encouraging are the production of cash crops like maize, cassava and cowpea. In the rural communities, women are mostly in the production and processing of cassava into Gari and cassava dough which is mostly found in Teiman. Another livelihood in the Ga-East municipality is non- traditional farming like grass cutter, rabbit and poultry rearing and the production of snails and mushroom.

#### **3.2.1K Central Gonja District**

##### I Location and size

The district lies at the southern end of the Northern region of Ghana. The district has common boundaries with Kintampo North district of the Brong-Ahafo region to the south. East Gonja district to the East, Tamale metropolis to the North and West Gonja district to the West. It has a total land size of 8353 square kilometers taking about 12 percent of the total land area of the Northern region. It has Buipe as it district capital. The population according to the 2010 population and housing census stood at 87,877 with 43,860 males and 44,017 females.

##### II Climate and Vegetation

The district experiences an unevenly distributed annual rainfall which last for only six months from May to October. The rainfall peak is in September with mean annual rainfall ranging from 1000mm to 1500mm. However, this has a little longer rainy season than any district or municipality in the northern region. Temperature shows seasonality and generally high throughout the year. The maximum temperature ever recorded is 40c<sup>0</sup> normally in March or April with mean annual temperature of 35c<sup>0</sup>. The

only forest reserve in the district is the Yakumbo forest reserve which occupies an area of 1200 hectares. This forest has the prospects for the production of valuable wood for construction and energy. This district is gifted with different appealing features sited in various areas of the district. An example is beaches along the lake Volta.

### III Agricultural sector

The major activities for the people in the district are fishing, live stocks rearing and crop production. Agriculture engages about 65 percent of the active population. Those in the production are normally engaged on their farms at period of raining season. Yam, maize, cassava, sorghum, groundnuts, rice, millet, cowpea, Bambara beans and soya beans are the major crops produced by the farmers with most farmers practicing mixed cropping. Good number of people are also into fishing along the Volta Lake and also in livestock rearing.

#### 3.2.1L Kpandai District

##### I Location and size

Kpandai district is at a location of South- Eastern part of the north of Ghana. It lies between longitude 0.29<sup>0</sup>E and 1.26<sup>0</sup>W and latitude 8<sup>0</sup>N and 9.29<sup>0</sup>N. It has common boundaries with East Gonja to the West, Nanumba South district to the North, Nkwanta North district to the East and Pru district in the Brong-Ahafo region to the South.

##### II Climate and Vegetation

Kpandai district is situated in the tropical continental climatic zone with the mid-day sun permanently overhead. Thus, temperature are relatively high ranging from 29<sup>0</sup>C and 40<sup>0</sup>C. The highest temperature is always recorded in December-January during the Harmattan period. The district experience the wet South-West Monsoon and the dry North-East trade winds which are accompanied by the rainy season and the dry Hamattan condition just like any part of West Afric.

##### III Agricultural Sector

The main occupation of the people in the Kpandai district is agriculture, it employs around 90 percent of the active population. Thus, it make up livestock and crop farmers and fishermen. Agriculture in the district is characterized with the use of crude and inefficient methods. Which make agriculture still at the primary stage of development.

Farming is not yet mechanized and people still use hoe and cutlass which depends on rainfall agriculture. Any form of irrigation is not practiced in the district although the district has a high potential with water resources for irrigation agriculture. Major crops grown in the district includes, maize, rice, yam, groundnut and cassava with most farmers practicing mixed cropping as a system of agriculture due to the fact that most crops are suitable to be inter-planted with others. Small ruminants and poultry are usually on free range or the extensive system with a smaller number of farmers practicing the Semi-intensive system. There is a lot of pasture land in the district which attracts livestock production and encourage inhabitants to take advantage to keep large herd of cattle and other livestock like sheep and goats. Also of importance is fishing predominantly occur along the Oti river and its tributaries. Several types of fresh water fishes are normally caught in the rivers. Most of the farmers are small scale farmers who mostly practice mixed cropping, mono cropping, crop rotation, and the integration of crop and livestock.

### **3.2.1M Bongo District**

#### **I Location and size**

This is one of the 13 districts in the Upper East region of Ghana and was created in 1988 by legislative instrument 1446 (LI 1446). Bongo district lies between latitude  $1050^{\circ}\text{N}$  to  $1109^{\circ}\text{N}$  and longitude  $0.45^{\circ}\text{W}$ . It has total land mass of 459.5 square kilometers and also has common boundaries with Bolgatanga Municipal and Nabdam district to the East, Kassena Nankana East to the West and Burkina Faso to the North. Bongo district lies within the Ondio-Cerciasis-freed zone.

#### **II Climate and Vegetation**

The district vegetation is of short deciduous type usually widely spaced. Most of the vegetation are of the original form. The shea, dawadawa and baobab are the few traditional and economic trees in the district. There exist the Red Volta Forest Reserve. Which promotes wildlife like monkey, baboons, rats, rabbits, grass cutters, mice, antelopes, dwarf buffalo and guinea fowls.

### III Agriculture sector

Erratic and short rainfall type followed by dry spell and peak periodic floods. Pest and diseases prevalence of both crops and livestock and the drying up of most of the existing water bodies during the dry seasons, Bush burning and indiscriminate felling of trees and reducing level of soil fertility of the existing nutrient-deficiencies soils are common in the district. The common crops grown by the peasant farmers during the short raining season from May to October are sorghum, rice, maize, groundnut, cowpea, soya beans, Bambara beans, pepper, onion, tomatoes, garden eggs, leafy vegetables. Rain fed mixed cropping is the main system of farming in the district. Crop mixture is mostly cereal-cereal but sometimes, cereal-legume mixture. The crop mixture may be early millet/ late millet. Early millet/sorghum/ local beans. After crop production, livestock and poultry rearing as the second agricultural activity. Most farmers are involved in the rearing of at least one type of livestock and poultry. Apart from pigs, livestock rearing is not normally done as a business in the villages. Normally, all the livestock and poultry are reared on free range system and hunting for fish is done in the few water bodies spared through the district with most of them needing re-habitation. It is mostly the women who are engaged in the processing activities.

#### **3.2.1N Nadowli-Kaleo District**

##### I Location and size

The district is situated at the centre of the Upper West region of Ghana and lies between the longitude of 31101 and 2101 west and the latitude of 100201 and 11030 North. It has boundaries with Burkina Faso in the West in the North by Jirapa and LambussieKarni district to the South by Wa municipal and to the East by Daffia-Bussie-Issa district. The district has a land size of 1132.02 sq km and extends from East to West from Daffiama to the Black Volta, from the Dapuori Bridge (almost 12km from Jirapa) on the main Wa-Jirapa-Hamile road to the Billi bridge (4km from Wa).

##### II Climate and Vegetation

The district lies within the tropical continental zone which annual rainfall confined to 6 months, from April to September which is also unevenly distributed and erratic with

occasional floods and dry spell. The district has a mean monthly temperature ranging between 36<sup>0</sup>C in March and 21<sup>0</sup> C on August and mean annual temperature of 32<sup>0</sup>C.

The annual precipitation or rainfall is about 1100mm with the peak in August. Between October and March is virtually no precipitation and has prolong dry season which is made severe by dry North East trade winds known as Harmattan. The district experience one agriculture production season from May to September. Also, the lack of development for irrigation agriculture has restricted crop production in the dry season where most farmers has no major farming operation to take.

### III Agricultural sector

Agriculture is the main activity in the district which employs about 85 percent of the people in the active labor. The main activities carried out in the district are livestock rearing and food crops with cash crop production. The crops production remains subsistence of household and family bases with low output level. The major crop found in the district are maize, millet, sorghum, yam, and cowpea. The few cash crops are cotton, groundnuts, soya beans, cassava, tiger nuts and pepper. The lack of market has therefore demotivated farmers from the production of cash crops. The major source of income for women is from the economic trees like shea, baobab and dawadawa which are still found wild and liable to distraction by annual bushfires. The traditional methods of farming using simple farm tools like cutlass and hoe are practiced by a higher majority of farmers in the district who are solely dependent on rainfall. A few are into mechanized farming with the use of intermediate technology using tractors services, animal drawn implement and some form of irrigation agriculture. Due to availability of sufficient land, farmers can practice bush fallowing system of farming combined with mixed farming or compound farming. Most subsistence farmers however practice mixed cropping, mono cropping and bush fallowing on large scale as a means of replenishing the fertility of the soil.

#### **3.2.10 Bia West District**

##### I Location and size

The Bia West district established by legislative instrument (L.I) 2013 is one of the twenty-two (22) districts, Metropolitan and Municipalities of the Western region of

Ghana. It has common boundaries with Juaboso district from the south, Bia East from the North and from the west, it shares boundary with Cote-De-voir. The administrative capital is Essam. From the 2010 population and housing census, the population of the district stand as 88939, with 45717 mal and 43222 females.

## II Climate and Vegetation

The district experiences the wet semi-equatorial climatic types which has two main seasons called the dry and wet season. The wet season comes between April and October, whilst the dry season is between November and March. The mean annual temperature is between 25.5<sup>0</sup>C and 26.5<sup>0</sup>C with mean annual rainfall lying between 1250mm and 2000mm. The climatic condition of the district encourages the growth of different crops both cash and food crops. This therefore position the district as one of the leading producer of cash crop like cocoa in the country. The vegetation of the district is moist semi deciduous or equatorial rain forest type, made up of various tree species like Ofram, Edinam, Oyina, Odum and Mahogany. The Bia tributaries and Manson forest reserve are both productive reserve where timber exploration is down. Human activities like poacher and encroachment of land, occasional bushfires are the major issues threatening the existence of these reserves. The type of climate too has an influence on the heavy rain experience in the district. Meanwhile, mechanized agriculture cannot be practiced widely because of the thick forest.

## III Agricultural sector

Agriculture is the main economic activity of the district. It employs 60 percent of the district's active population. Most houses are into agriculture or agriculture related activities as a means of livelihood. However, agriculture is mostly practiced as a small scale basis. Currently, main crop grown in the district are coffee, cocoa, yam, cocoyam, tomatoes, pepper, maize, plantain and cassava. Also, livestock like sheep, goats, cattle and glasscutters are reared in the district.

### **3.2.1P Jomoro District**

#### I Location and size

The district lies between longitude 02015<sup>0</sup>-02045<sup>0</sup>W and latitude 04055<sup>0</sup>-05015<sup>0</sup>N and share common boundaries to the North by Wassa Amenfi and Aowin Suaman districts,

Nzema East Municipal to the East, La cote deivoir to the West and Gulf of Guinea to the south.

## II Climate and Vegetation

The district lies within the semi-equatorial climate zones of the West African subregion. Rainfall is all year round with the peak in May and June every year. The mean temperature in the district is 30<sup>0</sup> with variation in mean between 4 to 5 degrees Celsius throughout the year. The moist semi deciduous forest type of vegetation is experienced in the northern part of the district and due to human activities like farming and tree felling, the south western part of the district is of secondary forest while the south along the coastal belt experiences coastal savannah. These includes vast of forest resource like timber and non-timber forest products, such as bamboo, game and wildlife and all this support to generate resource for development.

## III Agricultural sector

Agriculture is the main activity in the district, with arable farming and livestock rearing contributing much to the economic well-being of the people in the district. About 70 percent of the people are into agriculture as a living or obtain their livelihood from agriculture or agriculture related activity as fresh water and deep sea fishing and also coconut oil extraction. The district is gifted with good climate conditions, good sources of water like rivers and streams, good vegetation that favors crop growth, soil rich in nutrients or fertile soils able to support a variety of crops production. Cocoa, coconut, oil palm, rubber, cassava, plantain, rice, maize, cocoyam and vegetables are the major crops grown in the district. However, few people are into fishing and it related activities. Half Assin, Ahobre and Effasu are the main landing beaches.

### 3.2.1Q Keta Municipal

#### I Location and Size

The keta Municipality lies within latitude 5.45 degrees North and 6.00 degrees North and longitude 0.30 degrees East and 1.05 V East. It is at the Eastern part of the Volta estuary. 160 km East of Accra off the Aflao-Accra road and shares borders with Ketu North and South district to the East, South Tongu district to the West Akatsi South district to the North and the Gulf of Guinea to the South. From the total surface area of

about 1086 square kilometers about 362 square kilometers, about 30 percent is made up of water bodies.

## II Climate and Vegetation

The whole municipality lies within the coastal Savannah Zone. Five different vegetation zones can be redefined. Grasses interspersed with medium size trees with relatively high density are marked by the northern part of the municipality. The middle part of the municipality is also marked by short trees and short grasses with timely incidence of "pamira" palm and baobab trees. Characterized by mangrove plants along the Volta estuary at the South-Western part with tall grass for mat/hat weaving and fuel. With short grasses and many neem trees at the South-Eastern part along the coast from whuti, the coconut trees along the coast have been mostly affected by the St. Paul wilt disease which had a major influence on the rainfall pattern in the municipality. There also exist pockets of land mostly along the Dabala-Srogbe-Whuti highway which support little or no vegetation.

The Municipality experience the Dry Coastal Equatorial Climate, with annual mean rainfall of less than 1000 mm. The major rain comes between March and July and minor one starts in September and November. Mean temperature is about 30 degrees Celsius with low relative humidity. The whole municipality falls within the coastal savannah Zone.

## III Agricultural Sector

The Municipality is generally an agriculture districts with majority of people into agriculture, like crop production, livestock rearing, fishing and other related activities. It is one of the leading producer of vegetables in the region. It is well known for shallot production, which are usually grown along the flood plains of Amga and Keta Lagoons and Streams and some depression established by some farmers. Okro, tomato and pepper are also extensively grown either as pure stands or as inter- crops depending on the particular season, with very ideal site provided by alluvial soil along the lagoons. Maize, cassava, and coconut are grown as major season crops in the Northern part of the municipality while it is grown as an off season crops along the littorals. During the main cropping season, cowpea is a major crop grown in the northern part of the municipality around Abor, Weme and other surrounding towns. Also it is grown along the littoral during off season as green manure. Also found all over the municipality is

sweet potatoes but it is extensively grown in the northern part as compared to the other part of the region. Farm size is small in the municipality with an average of 0.5 hectares. The municipality has several water bodies which makes it a potential ground for fish breeding.

Livestock production is a secondary occupation to many farmers in the municipality. It is well known for the rearing of Ducks, and Goose. Local poultry too are kept by some farmers on free range. Few women rear turkey, but pigeons are activities for the well to do men. In most homes are found sheep and goats which are feed on household waste. In the middle belt where pasture is available are cattle and small ruminants. Another promising area for the municipality is oyster and other edible bivalves which are suitable candidates for export to developed countries.

### **3.2.1R North Dayi District**

#### **I Location and Size**

The District is bounded by south Dayi district to the south and the newly created Afadzato South District to the East. It is demarcated by Western boundary by the Volta Lake, which stretch over 80 kilometers of the coastal line. The district has a total land area of 462.8 square kilometers with about 30 percent of land being submerged by the Volta Lake. According to the 2010 population and Housing Census stands at 39,913 with 18,649 males and 21,264 females.

#### **II Climate and Vegetation**

Two types of rainy season are experienced in the district. The major one last from midApril to Early July while the minor last from September to November. There is no distinction between the starting and ending of the rainy season as such there is some times rainfall even during the dry periods. The mean annual rainfall range from 900 mm to 1300 mm with some variation in the time of onset, intensity and duration over the years. The district has a maximum vegetation of semi-deciduous forest and are along the slopes of the Akwapim-Togo-Attakora ranges with several tree species which are also found in the high forest zone such as Antians Tooxicaria (odum) and oil palm. While the savannah woodland consist of grasses with scattered trees like boabab,

bamboo and acasia. Due to human activities and inappropriate farming practices, excessively lumbering and occasional bush fires much of the forest has been lost.

### III Agricultural Sector

The district has a lot of agricultural resources like the large expand of suitable land for agriculture, pack house, the Volta Lake and River Dayi, which is the potential ground for fish farming. Food crops like rice, plantain, cassava, yam, maize and vegetables; garden Eggs are major crops grown in the district. Although grown on small scale, the production of crops are mostly rain fed with the traditional methods of farming using simple tools such as the hoe and cutlass. The average farm size per farmer is considerably low about 0.5 hectares. The main cash crops are cocoa and coffee grown in the high rainfall areas of Wusuta, Tsrukpa and Botoka, (ghanaditricts.gov.gh).

The next activity after crop production is livestock rearing. It is the second most important activity in the district. Fishing is dominant in about 30 communities in the district and engage about thousands of people along the Volta Lake covering about 80km stretching along the entire Southern border of the Volta Lake. There are seven Agricultural extension officers with Agriculture extension to farmer ratio of 1:3800 as against the standard of 1:1000 farmers.

#### **3.3 Study Population**

Population, according to Cresswell (2002), Fraenkel and Wallen (2000) and Koul (2002) denotes the whole set of entities (subjects or invents) holding common observable features in which the researcher is interested. According to Fink (2001), the criterion for the inclusion of a unit into a survey is based on the characteristics of the respondents who are eligible for participation in the survey. For the purpose of this study, the target population was all the Sixty (60) districts staff involved in the 2013 Ghana Agricultural production pilot survey as shown in Table 3.2 below, which a sample of eighteen districts were drawn.

Table 3.2 Regional Distribution of the Ghana Agriculture Production Survey Districts

Region	Districts	Region	Districts	Region	Districts
<b>Ashanti</b>	1 Amansie West 3 Adansi North 4 Afigya Sekyere 5 Amansie Central 6 Ejura 7 Atwima Nwabiagya 8 Ejisu Juaben 9 Kwabre East 10 Offinso North	<b>Brong Ahafo</b>	1 Dormaa East 2 Techiman 3 Asunafo North 4 Berekum 5 Kintampo North 6 Pru 7 Tain	<b>Eastern</b>	1 West Akim 2 Atiwa 3 Akwapem North 4 Birim Municipal 5 East Akim Municipal 6 Kwaebibirem 7 Kwahu North 8 Suhum-Kraboa
<b>Northern</b>	1 Yendi 2 Gushiegu 3 Bunkpurugu Yonyo 4 Gonja Central 5 Kpandai 6 Nанumba North 7 Sawla-Tuna-Kalba	<b>Central</b>	1 Mfantiman 2 Assin North 3 Abura-Asebu 4 Ajumako 5 Effutu Municipal 6 Gomoa East 7 Komenda-Edina	<b>Volta</b>	1 Keta 2 North Tongu 3 Akatsi North 4 Kadjebi 5 Krachi West 6 North Dayi
<b>Gt. Accra</b>	1 Ga West 2 Ga East 3 Dangbe East 4 Dangbe West	<b>Upper East</b>	Kassena Nankana East 2 Bawku Municipal 3 Bongo	<b>Western</b>	1 Prestea 2 Valley 3 Bia 4 Ahanta West 5 Jomoro 6 Nzema East 7 Tarkwa 8 Nsuaem

The table 3.2 above shows the all the districts from each region used in the Ghana Agricultural production survey, in total there were 60 districts from which a sample of 18 districts were chosen, using proportional allocation of about 20% from each district for the study.

### **3.4 Sample Size and Sampling Method**

A sample according to (Fink (2001)) is a portion or subset of a group. It is a representative of the larger group (population) if important characteristics (e.g. Age, gender, status) are distributed proportionately in both groups. The importance of sampling lies in the accuracy with which they represent or mirror the target population. The sample in this study consisted of a total of 108 respondents six respondents from each of the study districts. However, four respondents did not return their questionnaire, hence a total of 104 respondents were used for the study. The research used about 20% of offices in each region involved in the project for the study. This is in line with guidelines provided by (Fink (2001)) in his view “if the population is a few hundred 20% sample is appropriate. The project officers were considered for the study in view of the fact that they were directly involved in the project, who had experience in data collection, hence they were in a better position to bring their experience to bear in responding to the instrument regarding agricultural data.

Two types of sampling methods were used to select 18 out of 60 districts in the accessible population. Firstly, stratified sampling was used to stratify the districts according to the regions for geographic representation. A simple random sampling was then used to sample the districts in proportion to the number of districts in each region as shown in Table 3.3 below.

The use of stratified sampling is that, since a heterogeneous proportion of sub group might respond differently to the independent variable, a sampling procedure that divides the population into sub groups on the basis of the variable significantly correlated with the independent variable should be employed. In stratified sampling, the population of interest of N units is divided into sub population called strata. Each subgroup may be treated as a separate population from which a representative sample will be obtained. When a strata has been established, a sample is taken from every stratum. If simple

random sample is used in each stratum, the procedure is called stratified random sampling. This type of sampling is used if data of given precision are required for some subdivision of the population.

Table 3.3 Distribution of Districts and staff used in the Study

No.	Name of Region	No. of districts	No. of staff	No. of districts Sampled	No. of staff
1	Ashanti	10	60	3	18
2	Brong-Ahafo	7	42	2	12
3	Central	7	42	2	12
4	Eastern	8	48	2	12
5	Greater Accra	4	24	1	6
6	Northern	7	42	2	12
7	Volta	6	36	2	12
8	Western	6	36	2	12
9	Upper East	3	18	1	6
10	Upper West	2	12	1	6
	Total	60	360	18	108

### 3.5.1 Data Collection Method

Initial contacts were made with the selected districts, before embarking on the study. Permission were asked for from the district directors concerned with the mission and questions in the questionnaire explained to the respondents. The reason for this was to ensure that fitting responses was elicited from the respondents. The respondents were also assured of the confidentiality of their response in other to inspire them to respond

to the questions without hesitation. Two methods, Face to face interviews and email methods were adopted for the data collection. Sufficient time was allowed after which completed questionnaires were received through email or collected personally.

### **3.5.2 Data Collection Instrument**

One instrument-Questionnaire (In Appendix A) was used for the data collection. The questionnaire had two sections (A and B) and made up of 43 questions. Section A of the questionnaire consist of 7 questions dealing with personal information and demographic data of the respondents. The questions in section B were designed to collect information on respondent's perception satisfaction and challenges on agricultural data access. The responses to the questions in section B are also designed on a four point likert scale and coded Very true, True, Untrue, Very untrue, and Strongly Agree, Agree Disagree, Strongly disagree respectively. The likert-scale type appears to be the most popular method of attitude scale construction (Lebmann and Mehrens 1991). The reason is that Likert – scale type is easier to construct and score Also the Likert-type scale produce more homogeneous scales, allows respondents to indicate the degree or intensity of feelings and permit spread of difference.

### **3.5.3 Pretesting of Instrument**

According to Fritz (2004), pretesting of a questionnaire is important for the planning of good research because a large extent of the accuracy and interpretability of the survey findings lies on the pretesting stage. It is critical in identifying questionnaire problems. The relevance of pretesting is to assess the clarity of the questionnaire suitability to the respondents, the time required and the possible obstacles that could arise. The questionnaire was pretested in two districts. They were purposively selected for geographic representation, Binduri district in the northern sector and Suhum-Kraboia district in the south. Pieces of papers were added to the questionnaire for respondents to give their comments on the clarity, weakness, inadequacies ambiguities and problems on the questions in the instrument. Statements which seems ambiguous or misleading

were either removed or reviewed for clarity before the actual data collection. These two districts were not included in the sample for the actual survey.

### **3.6 Validity of Data**

A team of experts determined the content validity of the questionnaire, these included two consultants in the field of agricultural statistics and some other senior officers from the Food and Agriculture Ministry and their comments and suggestion were in cooperated into the restructuring of the questionnaire.



### 3.7 Data Processing and Analysis

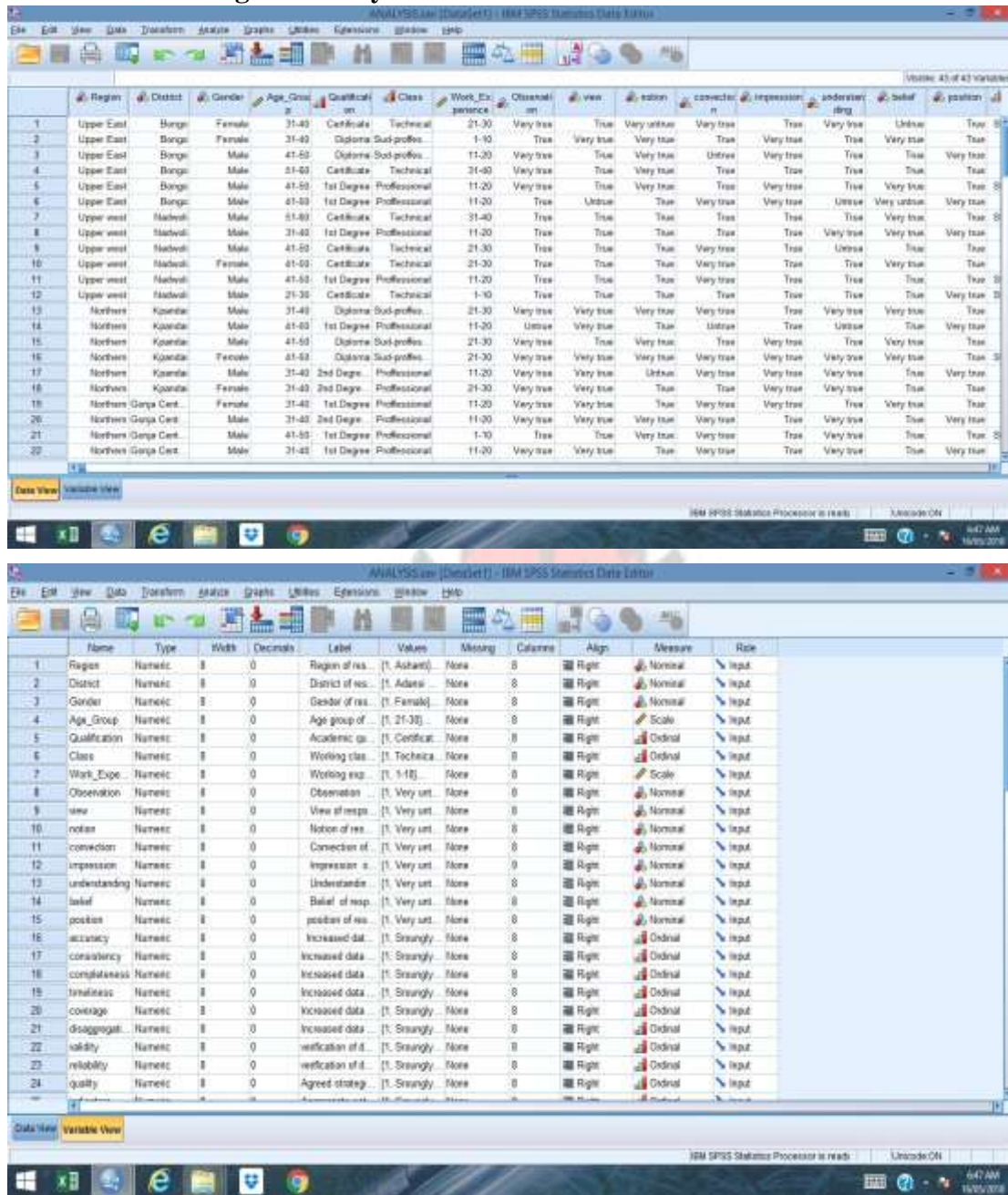


Figure 3.4: Screen shoots showing the interface of the software used in the data analysis.

Whatever the data collection method used, there are several steps that has to be followed to obtain the data in a form such that aggregates, averages or other statistics can be obtain. The data collected were edited to exclude questionnaires which were not completed. The questionnaires were serially number for easy identification, finally the questions were coded and entered into a computer. It was scored and tabulated on a four point likert type scale which was scored 4 3 2 1 for items with responses, strongly agree, Agree, Disagree and strongly disagree. All responses for each question in the

questionnaires was entered into SPSS vision 24 as shown on the screen shoots above and exported into excel for analysis. A minimum possible score was established based on the number of items that were generated, this helps in the establishment of percentage for each respondent to ascertain respondent's responses, frequencies and percentages were used to show the distribution on the responses. A high percentage score was regarded as positive, where as a low percentage score was regarded as negative.

With respect to perception, It was scored and tabulated on a four point Likert-type scale, which was scored 4, 3, 2 and 1 for items with responses; "Very True", "True", "Untrue" and "Very Untrue", respectively.

In the case of satisfaction, it was scored and tabulated on a four point Likert- type scale, which was scored 4, 3, 2, and 1 for items with responses; "Strongly

Agree", "Agree", "Disagree" and "Strongly Disagree", respectively. In the case of items with the responses "Not Sufficient", "Sufficient", and "Very Sufficient", "Not enough", "enough", "very enough", "Not effective", "effective", "very effective", and "Not efficient", "efficient", "very efficient", they were scored 1, 2 and 3 respectively.

During the discussion of the results, research questions were answered by describing the relevant data using descriptive statistics. Percentages and frequencies were used to get the direction of respondents as well as the challenges associated with improving Agricultural data access. This was because the scale of measurement of the variables assumed that the sampling distribution was normal in shape hence the standardized normal distribution could be used (Healey, 2002).

### **3.8 Delimitations**

Restrictive weakness in the data collection may affect the study, hence only one instrument (Questionnaire) was used. If other Instruments such as the interviews on focus group discussion had been used, the quality of the study could have been improved upon

Another limitation was delay in returning the completed questionnaires. Several phone calls were made to some of the respondents to return the completed questionnaires.

### **3.9 Ethical Consideration**

Ethics in research refers to the correctness of the researcher's behavior in relation to the right of participants or the people who are involved and may be affected by it. Considering this, the research ethics was adhered to. Permission was sought for from participants before starting the data collection process, participation was voluntary and participants were free to opt out at any stage of the interview process without restrictions. To ensure high ethical standard, names of respondents were not asked. Also, respondents were assured of the confidentiality of the information and that it was solely for academic purpose. The study also acknowledge other sources of information used in reviewing the study.



## **CHAPTER FOUR**

## **PRESENTATION, ANALYSIS AND DISCUSSION OF DATA**

### **4.0 Introduction**

This chapter discusses how the data collected for the study were analysis. One set of questionnaire was used to collect the data through face to face interviews and email. Statistical Product for Service Solution (SPSS) version 24 was used to analyze the data and the results presented in the form of Tables and charts. This chapter is also organized under two main headings, the first section covers the results of the analysis of the personal information of the respondents involved in the study, while the second section covers the results of the main data of the study.

The analysis and discussions are centered on respondent's perception and satisfaction on the integrated data management system - Ghana Agricultural Survey (GAPS) in accessing data. The chapter also analysis some challenges of respondents in accessing quality agricultural data and their opinion on the effectiveness and efficiency of the integrated data management system, GAPS. Tables and charts were used to illustrate and support findings wherever applicable.

### **4.1 SECTION A Personal Information of Respondents**

This section which deals with personal information of the respondents, includes Gender, Age group, Working class, Educational qualification and Working experience.

The sample size was one hundred and four (n=104) respondents. Both males and females were involved in the study, however, males were more than females. Out of the 104 respondents representing 100%, 77% (n=80) were males and 23% (n=24) were females.

Respondents age were group into four age groups as 21-30, 31-40, 41-50, 51-60, the minimum age of 21 and maximum of 60, the assumption was that age 21, it is possible for one to be employed in the Agricultural ministry and age 60 is maximum age limit for one to still be working in the ministry. The study shows that, 7%, (n=7) belongs to age group 21-30, 41%, (n=43) belongs to age group 31-40, 38%, (n=40) belong to age group 41-50, and 14%, (n=14) belong to age group 51-60. Regarding working class of respondents, 20%, (n=21) were Technical staff, 22%, (n=23), Sub- professional and a majority 58%, (n=60) were Professional. See table 4.1 below.

Table 4.1 Personal Information of Respondents

Variable	Frequency	Percentage
<b>Gender</b>		
Female	24	23
Male	80	77
Total	104	100
<b>Age Group</b>		
21-30	7	7
31-40	43	41
41-50	40	38
51-60	14	14
Total	104	100
<b>Working Class</b>		
Technical	21	20
Sub- Professional	23	22
Professional	60	58
Total	104	100
<b>Qualification</b>		
Certificate	21	20
Diploma	18	17
1 <sup>st</sup> Degree	54	52
2 <sup>nd</sup> Degree(Masters and PHD)	11	11
Total	104	100
<b>Working Experience(Years)</b>		
1-10	16	15
11-20	39	38
21-30	28	27
31-40	21	20
Total	104	100

The study also shows that a majority of the respondents 52%, (n=54) holds 1<sup>st</sup> degree, followed by Certificate 20%, (n=21), then Diploma 17%, (n=18) and the least, 2<sup>nd</sup> degree 11%, (n=11). To know the level of working experience of respondents, it is revealed that, many of the respondents, 38%, (n=39) had working experience between

11-20 years, While, 27% (n=28) were in the year group 21-30, 20%, (n=21) in year group 31-40 and the least. 15%, (n=16) in year group 1-10. See Table 4.1 above.

**4.1 SECTION B Graphical Representation of Respondents personal Information**

**1 Gender of the Respondents**

A sample of one hundred and four (104) respondents were selected from eighteen (18) districts across the country. The Figure 4.1 shows that out of the 104 respondents, 23%, (n=24) were females and 77%, (n=80) being males. This is an indication that almost one female out of four males were involved in the study

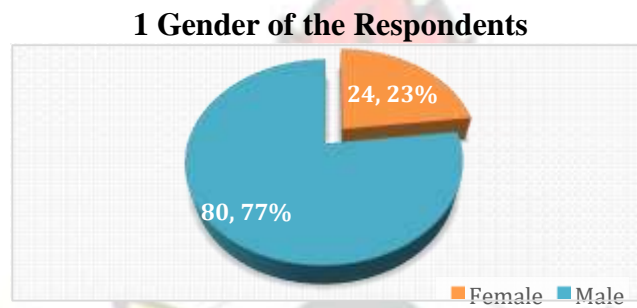


Figure 4.1 Gender Distribution of Respondents

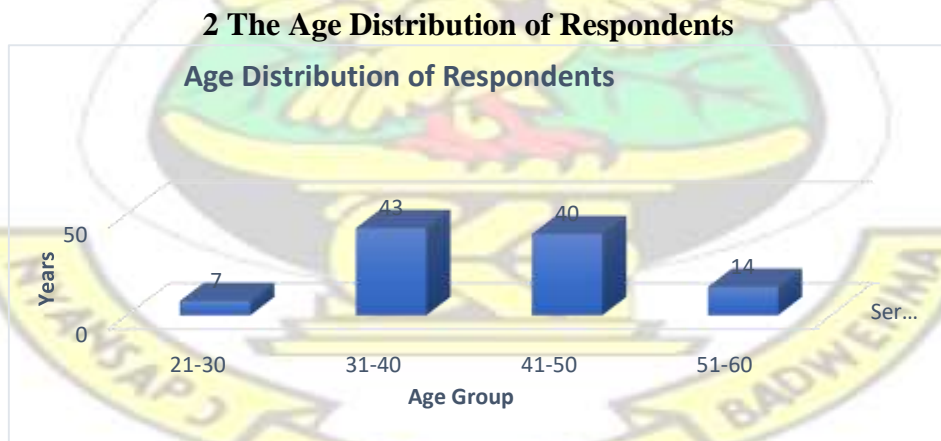


Figure 4.2 Age Distribution of Respondents

The age of the respondents were classified into four age groups as shown in Figure 4.2 above. The information above portrays that out of the total of 104 respondents who completed the questionnaire, majority of them 80%,(n=83) falls within the age group 31-40 and 41-50 combined , while 14%, (n=14) falls in age group 51-60 and only 7%,

(n=7) within age group 21-30. This confirms that most of the respondents were not too young or too old to understand issues concerning the system.

### 3 Working Class of Respondents

The respondents were categorized into working class as Technical, Sub- professional and Professional as shown in Figure 4.3.

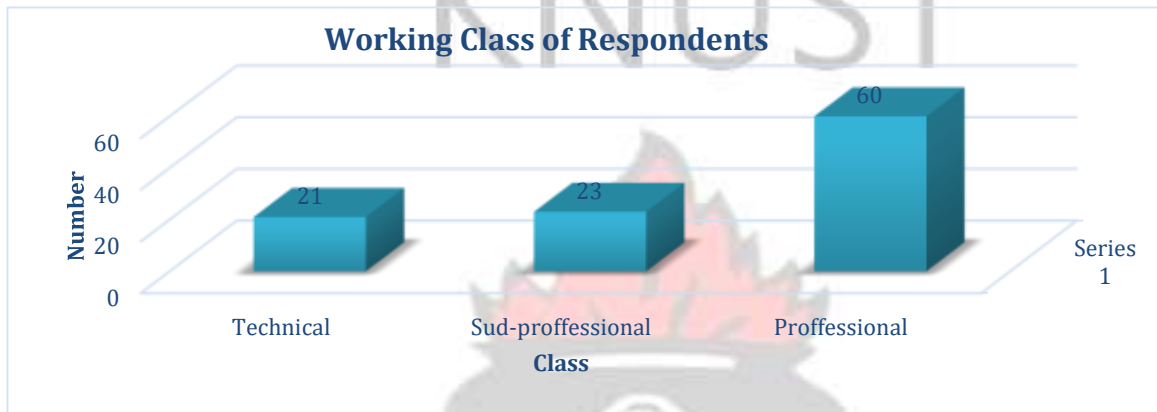


Figure 4.3 Working Class of Respondents.

As indicated in Figure 4.3, of the 104 respondents drawn for the study, 58%, (n=60) were professionals, while 20%, (n=21) and 22%, (n=23) being Technical and Subprofessionals respectively. This revelation implies that most respondents had adequate knowledge on information about the Agricultural data management systems.

### 4. Educational Qualification of Respondents

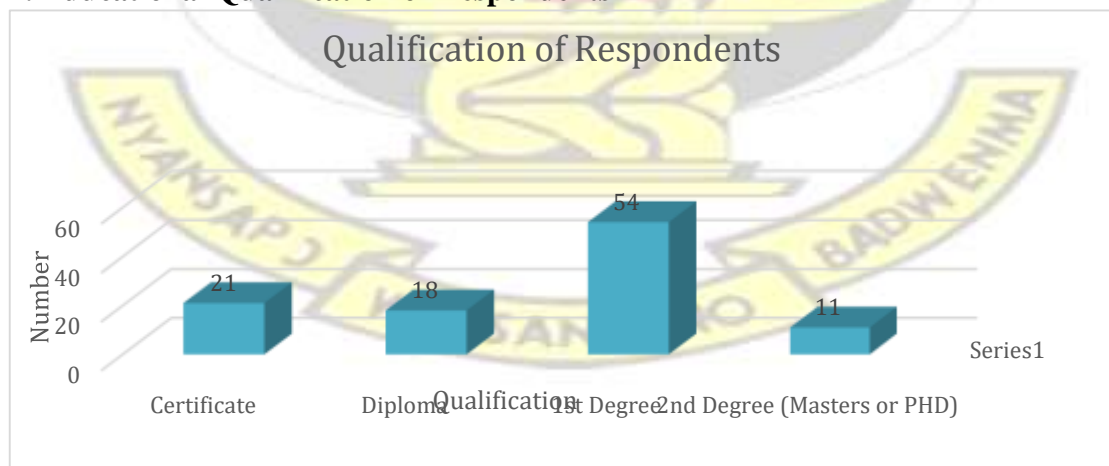


Figure 4.4 Educational Qualification of Respondents.

The Educational qualification of the respondents were identified as Certificate, Diploma, 1<sup>st</sup> degree and 2<sup>nd</sup> degree (Masters or PHD).

The above, Figure 4.4 shows that majority of the respondent's holds 1<sup>st</sup> degree and above in Agriculture. The 1<sup>st</sup> degree alone were 52%, (n=54), 2<sup>nd</sup> degree 11%, (n=11) while Certificate and Diploma forms 20%, (n=21) and 18%, (n=18) respectively

## 5 Working Experience of Respondents

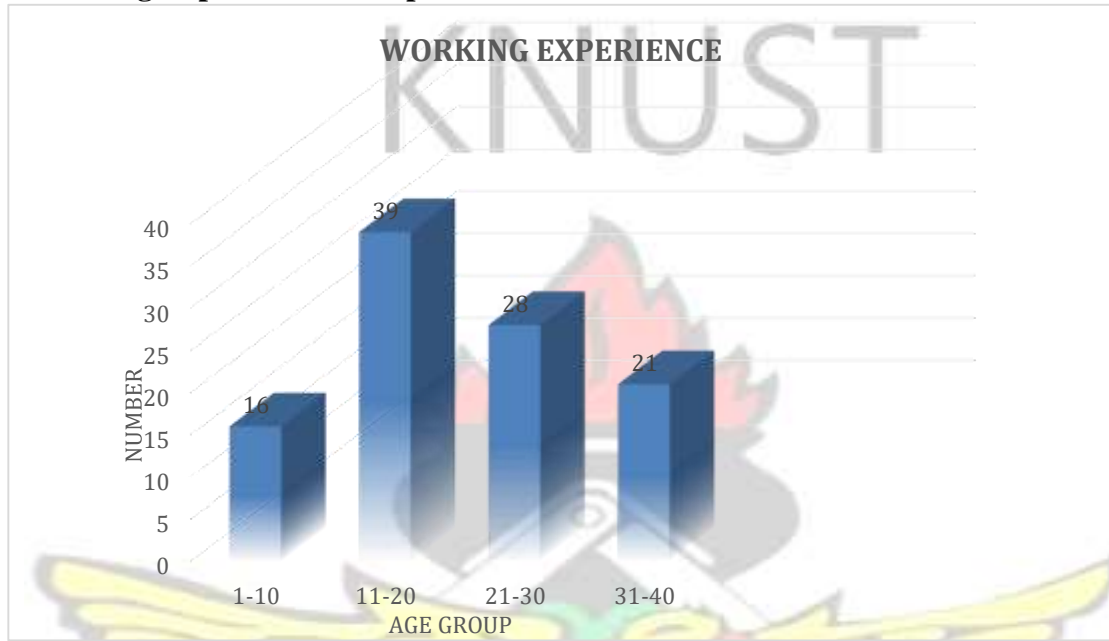


Figure 4.5 Working Experience of Respondents.

The study found out that more respondents 38%, (n=39) belong to year group 11-20, than any other group. While, 27% (n=28) were in the year group 21-30, 20%, (n=21) in year group 31-40 and the least 15%, (n=16) in age group 1-10

## SECTION B ANALYSIS OF THE MAIN DATA

### 4.2.1 Frequency Distribution of the Perception Statement of Respondents

For effective data management, data producers should have higher or favorable perception of the system. The questions were used to find respondents perception about the data management system that is the Ghana Agriculture production survey (GAPS). Responses in section B specifically to items 8,9,10 11,12,13,14 and 15 on the questionnaire were employed to address this. It encompassed statement such as, the observation about the importance of agriculture data, views in putting together emerging issues to seek solution to the problems of agriculture data integration, the notion of effectively integrating agricultural data, the convection of agricultural data

leading to effective decision making and policies formulation, the impression of the major solution to the problems of agricultural data access by promoting integration. Others are understanding of quality being an enhancement to agricultural data access, the belief of devoting time to the collection of agriculture data and the position of agricultural data collection being at the heart of every agricultural organization.

The results of the respondent's level of perception of agricultural data integration were presented using frequencies and percentages. Respondents responded very true, true, untrue and very untrue to the eight items. Table 4.2 shows the results on the level of respondent's perception of the system.

Table 4.2 Perception Statement of Respondents

Perception Statement	Very True		True		Untrue		Very Untrue	
	N	%	N	%	N	%	N	%
My observation is that Agriculture data is important for decision making	47	45.2	50	48.1	4	3.8	3	2.9
My view is that the emerging issues should be put together to seek solutions to the problems of Agricultural data integration	46	44.2	53	51	3	2.9	2	1.9
My notion is that Agricultural data can be effectively integrated for decision making	39	37.5	58	55.8	5	4.8	2	1.9

My convection is that Agricultural data lead to effective decision making and policies at district regional and national levels	43 41.3	54 51.9	5 4.8	2 1.9
My impression is that the major solution to the problem of Agricultural data access is to promote integration	30 28.8	66 63.5	6 5.8	2 1.9
My understanding is that the provision of quality is an enhancement to the Agricultural data access	30 28.8	63 60.6	8 7.7	3 2.9
My belief is that it is possible to devote time to agricultural data collection.	40 38.5	55 52.9	7 6.7	2 1.9
My position is that Agricultural data collection should form an integral part of every organization.	35 33.7	63 60.6	5 4.8	1 1

The table 4.2 shows the responses of respondents to the perception statements which were sougled. In response to the statement “My observation is that Agriculture data is important for decision making”, 45%, (n=47) responded very true, 48%, (n=50) answered true, while 4% (n=4) and 3%, (n=3) responded untrue and very untrue respectively. In responding to the statement” My view is that the emerging issues should be put together to seek solutions to the problems of Agricultural data integration”, 44%, (n=46) respondents answered very true, 51%, (n=53), responded true, 3% (n=3) indicated untrue, while 2%, (n=2) responded very untrue. When respondents were asked about “My notion is that Agricultural data can be effectively integrated for decision making”, 38%, (n=39) answered very true, and 56%, (n=58) answered true, while only 6%, (n=7) indicated untrue and very untrue. Also in response to the statement “My convection is that Agricultural data lead to effective decision making and policies at district, regional and national levels”, 41%, (n=43) said very true, 52%, (n=54), showed true, with 5%, (n=5) saying untrue and 2%, (n=2) indicating very untrue. In the same vein, in response to the statement “My impression is that the major solution to the problem of Agricultural data access is to promote integration”,

29%, (n=30) said very true, while 64%, (n=66) answered true, with only about 8%, (n=8) responding to untrue and very untrue. In addition, in reaction to the statement, "My understanding is that the provision of quality is an enhancement to the Agricultural data access", 29%, (n=30) said very true, 61%, (n=63) stated true, while 8%, (n=8) answering untrue and 3%, (n=3) saying very untrue. Also in response to the statement "My belief is that it is possible to devote time to agricultural data collection", 39%, (n=40) showed very true, with 53%, (n=55) saying true, while only 7%, (n=7) and 2%, (n=2) giving untrue and very untrue respectively. Furthermore, in reply to the statement "My position is that Agricultural data collection should form an integral part of every organization ", 34%, (n=35) said very true, 61%, (n=63) said true, and only 6%, (n=6) saying untrue and very untrue.

The responses of the respondents to the perception statements calls for discussions, the response were overwhelmingly one sided, 93%, (n=97) respondents answered very true or true, whereas, only 7%, (n=7) either responded untrue or very untrue.

A signal that respondents perceived Agricultural data as a tool for effective decision making.

With the view is that the emerging issues should be put together to seek solutions to the problems of agricultural data integration, almost all the respondents 95%, (n=99) testified that emerging issues can be clued together as means of getting answers to the problems of agricultural data integration.

The statement, "My notion is that Agricultural data can be effectively integrated for decision making", falls under the emotional aspect of perception, because the statement had positive response with very high or favorable perception. Respondents were expected to answer very true or true, the results shows that, a greater number of respondents 94%, (n=97) responded very true or true, while only 6%, (n=7) answered untrue or very untrue.

Also, with convection is that Agricultural data lead to effective decision making and policies at district, regional and national levels, majority 93%, (n=97) responses confirms that agricultural data leads to effective decision making and policies formulation at the decentralized (district), regional and the national levels.

Again, to the statement, “My impression is that the major solution to the problem of Agricultural data access is to promote integration”, the story is not different, a majority 93%, (n=96) accepted the statement. This confirms that, promotion of data integration would help improve of agricultural data access.

Similarly, to the statement, “My understanding is that the provision of quality is an enhancement to the Agricultural data access” mostly 90%, (n=93) had positive understanding .This shows that quality is an enhancement to the access of agricultural data.

Added to the above is, the belief that it is possible to devote time to agricultural data collection and the position that Agricultural data collection should form an integral part of every organization. These two statements above both gave very high perception level 92%, (n=95) and 95%, (n=98) respectively, which is a sign of strong belief that is it possible to devote enough time to agricultural data collection which can be an integral part of every agricultural organization.

From the analysis and discussion above, it could be noticed that the general perception of the respondents about the integrated data management system is very high or favorable. However, there is the need to institute measures to sustain this high perception. See Table 4.2 above.

#### 4.2.2 Frequency Distribution of the Satisfaction Statement of Respondents

This subsection tries to find out the satisfaction of respondents in using the integrated management system. The items on this part of the questionnaire sought information on satisfaction level on data quality, issues on sampling, use of standards measures and data governance procedures. Also, for comprehensive data analysis, two level of satisfaction were developed, specifically, very high satisfaction and low satisfaction. Respondents responded strongly agree, Agree, Disagree and strongly disagree to each of the items in this section and the results presented in tabular form as frequencies and percentages.

Table 4.3A Satisfaction Statements of Respondents

Satisfaction	Strongly agree		Agree		Disagree		Strongly disagree	
	N	%	N	%	N	%	N	%

QUALITY AND ACCESS								
Increased data accuracy	29	27.9	64	61.5	9	8.7	2	1.9
Increased data consistency	38	36.5	61	58.7	3	2.9	2	1.9
Increased data completeness	33	31.7	66	63.5	3	2.9	2	1.9
Increased data timeliness	40	38.5	58	55.8	4	3.8	2	1.9
Higher coverage	35	33.7	63	60.6	5	4.8	1	1.0
Higher disaggregation	44	42.3	52	50.0	6	5.8	2	1.9
Verifying the validity of data	30	28.8	55	52.9	16	15.4	3	2.9
Verifying the reliability of data	19	18.3	54	51.9	27	26.0	4	3.8
There are agreed strategies for data quality assurance	16	18.3	64	61.5	20	19.2	1	1.0
The system produces an appropriate set of indicator to access data	16	15.4	69	66.3	16	15.4	3	2.9
Data are stored or archived, so that it can be access by users.	24	23.1	65	62.5	13	12.5	2	1.9
Data is produced , using advance technology like GPS	48	46.2	50	48.1	5	4.8	1	1.0

Under the sub-section Quality and Access, respondents were asked as to whether the system had realized an increased in data accuracy, consistency, completeness, timeliness, Higher coverage, Higher disaggregation and process in place for verifying the validity and reliability of data collected, agreed strategies for data quality assurance, appropriate set of indicators to access data, Data storage or archiving, Data produced using advance technology.

In response to the data accuracy, 28%, (n=29) said they strongly agree 62%, (n=64) agree, 9%, (n=9) disagree, while only 2%, (n=2) said they strongly disagree. With increased in data consistency, 37%, (n=38) strongly agree, 59%, (n=61) agree and 5%, (n=5) disagree or strongly disagree. For completeness, 95%, (n=99) strongly agree or Agree while 5%, (n=5) disagree or strongly disagree.

For disaggregation, 42%, (n=44) strongly agree, 50%, (n=52) agree, and 8%, (n=8) disagree or strongly disagree. With process for verifying validity, 29%, (n=30) strongly agree, 53%, (n=55) agree, and 18%, (n=19) disagree or strongly disagree. Also to the process in place for verifying reliability of data collected, 70%, (n=73) strongly agree or Agree and 30%, (n=31) Disagree or strongly disagreed. To strategies for quality assurance, 80%, (n=80) strongly agree or agrees and 20%, (n=24) disagree or strongly disagree. To the “The system produces an appropriate set of indicator to access data”, 15%, (n=16) said strongly agree, 66%, (n=69) agree, 15%, (n=16) disagree and just 3%, (n=3) strongly disagreed. To data storage and achieving, 86%, (n=89) said strongly agree or agree and 14%, (n=15) disagree or strongly disagree. For the use of advance technology, most respondents 94%, (n=98) strongly agree or agree and only 6%, (n=6) disagree or strongly disagree.

Results of the analysis on the quality of data shows that majority of the respondents exhibited greater satisfaction or very strong agreement to the system. See Table 4.3A above.

Table 4.3B Satisfaction Statements of Respondents

Satisfaction	Strongly agree		Agree		Disagree		Strongly disagree	
	N	%	N	%	N	%	N	%
<b>Sampling</b>								
Sampling frame is adequate	18	17.3	55	52.9	25	24.0	6	5.8
Sampling method is accurate	31	29.8	57	54.8	15	14.8	1	1.0

Sampling design is consistent with Research objectives	30	28.8	63	60.6	6	5.8	5	5.8
Sampling errors are correctly assessed	16	15.4	46	44.2	37	35.6	5	4.8
<b>Standard</b>								
Sound statistical concepts are used	11	10.6	49	47.1	42	40.4	2	1.9
There are strategies for reconciliation of data	10	9.6	46	44.2	46	44.2	2	1.9
There are strategies for harmonization of data	8	7.7	51	49.0	42	40.4	3	2.9
Data is produced according to international acceptable standards	11	10.6	44	42.3	44	42.3	5	4.8
<b>Data governance</b>								
There are existing statistical legislation in place	4	3.8	41	39.4	49	47.1	10	9.6
There are mechanism in place for consultation between producers and users	1	1.0	24	23.1	60	57.6	19	18.3
The existing legislation and institutional frame work	5	4.8	20	19.2	66	63.5	13	12.5

The sub-section sampling, sought to find out respondents opinion on the adequacy of the sampling procedures concerning the system. The four items under this were, sampling frame is adequate, sampling method is accurate, sampling design is consistent with research objectives and Sampling errors are correctly assessed. To the statement on sampling frame, 70%, (n=73) strongly agree or agree and 30%, (n=31) disagree or strongly disagreed. In response to Sampling design is consistent with research objectives, 90%, (n=93) strongly agree or agrees, and 10%, (n=11) disagree or strongly disagree. On assessment of sampling errors, 59%, (n=62) strongly agree or agree, while 41%, (n=42) disagree or strongly disagree.

The results shows that respondents had high level of satisfaction on sampling procedures.

To statement, “Sound statistical concepts are used”, 58%, (n=60) strongly agree or agree, while 42%, (n=44) disagree or strongly disagree. Also, in answer to the statement, “There are strategies for reconciliation of data”, 54%, (n=56) strongly agree or agree, while 46%, (n=48) disagree or strongly disagree. Again, in a similar view,” There are strategies for harmonization of data,” 57%, (n=59) replied strongly agree or agree, and 43%, (n=45) respondents disagree or strongly disagree. Furthermore, in reply to the statement, “Data is produced according to international acceptable standards”, 52%, (n=55) said strongly agree or agree, and 48%, (n=49) respondents disagree or strongly disagree.

It can be concluded that respondents had dissimilar views or divided mind on the standard procedures with regards to the system.

Three items were used to seek information on data governance involved in getting the required data. That is, There are existing statistical legislation in place, There are mechanism in place to for the consultation between producers and users ,The existing legislation and institutional frame work adequately reflect the mandate for collection of Agricultural statistics. In reaction to the statement, “There are existing statistical legislation in place”, 43%, (n=45) responded strongly agree or agree, and 57%, (n=59) respondents disagree or strongly disagree. Also to the statement, “There are mechanism in place for the consultation between producers and users”, only 24%, (n=25) responded strongly agree or agree, while a majority 76%, (n=79) respondents disagree or strongly disagree. Finally to the statement, “The existing legislation and institutional frame work adequately reflect the mandate for collection of Agricultural statistics”, only 24%, (n=25) responded strongly agree or agree, while majority 76%, (n=79) respondents disagree or strongly disagree.

This analysis also reveals that respondents had a negative view or low satisfaction level about data governance on the system. See Table 4.3B above.

#### **4.2.3 Frequency Distribution of the problems in using the system**

This section tries to find out the encountered in using the systems, the items on this part of the questionnaire required information on time and logistics used in connection with the system. The study found that, out of the 104(100), respondents almost half 55% (n=57) said the time given for the collection of data is not sufficient, about 37%, (n=38)

indicated the time is sufficient and only 9%, (n=9) said it is very sufficient. Also, 46%, (n=48) stated that time given for training in the data collection is not sufficient 48%, (n=50) perceived that training time is sufficient and just about 6%, (n=6) said it is very sufficient. To find out about the logistics provided, about 37%, (n=38) respondents stated not enough, but more than half of the respondents about 57 %, (n=59) stated enough while about 7%, (n=7) indicated is more than enough. See Table 4.5 below.

Table 4.4 problems in using the system

Variable	Response	Frequency	Percentages
Data collection time	Not sufficient	57	54.8
	Sufficient	38	36.5
	Very sufficient	9	8.7
Training Time	Not sufficient	48	46.2
	Sufficient	50	48.1
	Very sufficient	6	5.8
Logistics provided	Not enough	38	36.6
	Enough	59	56.7
	More than enough	7	6.7

#### 4.2.4: Cross Tabulation of Respondents Working Experience and Opinion about the Effectiveness of the System

This subsection tries to compare respondents working experience to the effectiveness of the system, the items on this part of the questionnaire sought information on the effectiveness of the system. The study found that out of 16(100%) of those who belong to the year group 1-10, 25 %, (n=4) stated that the system is very effective, about 69%, (n=11), said it is effective, while only 6%, (n=1) indicated it is not effective. For year group 11-20, out of 39,(100%), about 21 %, (n=8) responded it is very effective, about 62%, (n=24) said it is effective and about 18%, (n=7) responded not effective. Again, for year group 21-30, with 28, (100%) respondents, about 21 %, (n=6) indicated very effective, about 61%, (n=15) said effective, while about 18%, (n=5) said it is not effective. Among the respondents 21, (100%) who belong to year group 31-40, about 24%, (n=5) stated very effective, a majority about 71%, (n=15) said it is effective, a

small percentage 5 %,( n=1) thinks is not effective. Generally, of the 104, (100%) about 22%, (n=23) perceived it is very effective, most respondents 64%, (n=67) claims it is effective, while a few 14 %,( n=14) stated it is not effective. In the nutshell, it can be concluded that the system is effective in achieving the intended objectives. See Table 4.5 below.

Table 4.5: Cross tabulation of respondents working experience and opinion about the effectiveness of the System

Experience	Year Group		Opinion			Total
			Not Effective	Effective	Very Effective	
1-10		Count	1	11	4	16
		%	6.2	68.8	25	100
11-20		Count	7	24	8	39
		%	17.9	61.6	20.5	100
21-30		Count	5	17	6	28
		%	17.9	60.7	21.4	100
31-40		Count	1	15	5	21
		%	4.8	71.4	23.8	100
Total		Count	14	67	23	104
		%	13.5	64.4	22.1	100

**4.2.5: Cross Tabulation of Respondents Working Experience and Opinion about the Efficiency of the System**

On the issue of efficiency, the study reveals that out of 16(100%) of those who belong to the year group 1-10 in terms of working experience, about 19 % ( n=3) stated that the system is very efficient, majority, about 56%, (n=9), indicated it is efficient, while only 25%, (n=4) indicated it is not efficient. For year group 11-20, 39,(100%), about 15 %,( n=6) responded it is very efficient, many, 64%, (n=25) said it is efficient and about 21%, (n=8) responded not efficient. Again, for year group 21-30, with 28, (100%) respondents, about 14 %,( n=4) indicated very efficient, many, about 75%,

(n=21) said efficient, while about 11%, (n=3) said it is not efficient. Considering the respondents 21, (100%) who belong to year group 31-40, about 38%, (n=8) stated very efficient, 43%, (n=9) said it is efficient, a small percentage 19 %,( n=4) thinks it is not efficient. Generally, of the 104, (100%) about 20%, (n=21) perceived it is very efficient, most respondents 62%, (n=64) claims it is efficient, while a few 18 %,( n=19) stated it is not efficient. In a nut-shell, it can be concluded that the system is efficient in making maximum use of the available resources. See Table4.6 below.

Table 4.6: Cross tabulation of respondents working experience and opinion about the efficiency of the System

Experience	Opinion					
	Year Group		Not Efficient	Efficient	Very Efficient	Total
1-10	Count	4	9	3	16	
	%	25	56.3	18.8	100	
11-20	Count	8	25	6	39	
	%	20.5	64.1	15.4	100	
21-30	Count	3	21	4	28	
	%	10.7	75	14.3	100	
31-40	Count	4	9	8	21	
	%	19	42.9	38.1	100	
Total	Count	19	64	21	104	
	%	18.3	61.5	20.2	100	

### 4.3 Discussion of findings

In this sub-section of the thesis is the discussion of the findings in relation to the existing literature and the summary of the key findings. Agriculture data is important means in making policy decision in Ghana. Therefore, ensuring that quality agricultural data is accessible at all times is necessary for sustainable development. The objectives of the study were to examine the perception and satisfaction of respondents on the usefulness of the integrated data management system, to identify the challenges involve in accessing these data and to explore means in improving accessibility and quality of these data. To achieve the study objectives, the researcher sampled one hundred and

four (104) respondents from eighteen districts from Ghana who were involved in the Agricultural production survey and interviewed them with a structured questionnaire. The study found that there were males than females. This is understandable because it conforms to what is in the human resource database of the ministry of food and Agriculture. The study also found that many of the respondents belong to the age group 30-40 and 41-50, this implies that they were not too young and too old to contribute to any decision regarding agricultural data in the country. The study also found that a majority of the respondents were professional which again signifies that any decision taken were almost of professional standard. Furthermore, with educational qualification and working experience of respondents, the distributions were almost normal. This is an indication that the respondent's contribution to improvement in Agriculture data access were understandable because they had the request qualification and experience in agricultural data management.

The perception of respondents is necessary in accessing the quality of any system, and for any good system respondents should have high perception about it. Also observation is an important indication of perception. The study reveals that, a majority of the respondents had a high perception about system. Respondents could also assess perception through their views, notion, convection, impression, understanding, belief and position, and a majority of the respondents showed high perception to these items. The researcher also noticed from his personal observation that other stakeholders showed in the same direction of high perception. Evidence from the Food and Agriculture sector Development Policy (FASDEP II, 2007) shows that, they are policies in place to strengthen Agriculture Information systems in Ghana. However, the policies were not well communicated to most of the stakeholders of Agriculture.

The satisfaction of Agriculture data providers is a major dimension of processes of quality. Low satisfaction may sway data users, while high satisfaction can attract data users. The study found that a majority of respondents on all aspect of sampling were high. Also standard is another major dimension of quality processes, adhering to the appropriate standard protocols contributes to the comprehensiveness and hence the quality of data produced. The study shows that there were divided views regarding standard, almost half of the respondents had low satisfaction on items on standard, as such, there exist the need to review the standard procedures used in the implementation of the system.

Again. Governance is also of importance to any data management system. To ascertain whether respondents are satisfied with the existing legislation, mechanism for consultation and the institutional framework, the stories were not different from that of standards, the results indicates that in general, the respondents are not in favor of the data governance in the system.

Even though respondents over all perception and satisfaction were good to most of the items, some respondents raised some concerns that need to be addressed. The study found that some respondents faced challenges in accessing data on the field. Among the challenges were, time allotted for training and data collection and also, logistics provided for data collection. These findings are similar to findings of existing studies, in Zambia, (Mmani and Magnani (2003)), found lack of resources among others as challenges to accessibility. There is also much literature to support this.

The study then tries to find whether working experience of respondents has any influence in drawing conclusion about the effectiveness and efficiency of the system. It was revealed from the study that the working experience of respondents has no influence with regards to decision making. However, the general observation from the study reveals that a majority of the respondents stated that system is both effective and efficient, despite the fact that there were some challenges.

## **CHAPTER FIVE**

### **THE SUMMARY, CONCLUSION AND RECOMMENDATIONS**

#### **5.0 Introduction**

It is in this chapter that, the summary, conclusion as well as the recommendations drawn from the study and the mechanisms to improve agriculture data access are presented. The most important idea behind the study was to obtain experience from the detail procedures that is applied in the Ghana Agricultural Production Survey (GAPS) and to consider same in the planning for the up-scaling of the undertaking to cover the entire country. Another objective is to observe the suitability of the data (survey) and report

the findings that can be exploited to enhance the effectiveness and usefulness of the collection of agricultural data at the different stages of authority for the agricultural sector. Several strategies concerning the quality of data were applied involving an effective involvement with key interested parties associated to the discharge of the GAPS. These consist of officers at the various districts who had several years' experience and requisite qualification in agricultural data collection. The major thought built from the process is that the recently initiated GAPS is a laudable idea in principle and have to be supported. The reason being that the survey (GAPS) is planned in a way to offer reliable and regular information on agriculture in Ghana that does not depend strongly on extended memory of farmers.

### **5.1 Summary of the study Findings**

The study used a descriptive sample survey with a sample size of one hundred and four (104) respondents, one research instrument for the data collection and the data analyzed using SPSS Version 24 with descriptive statistics (frequencies, percentages and counts) and presented in the forms of tables and charts.

The findings were that about 90% of the respondents in the study districts had very high perception about the system .

The study made a point on data quality which showed that a majority about 80% exhibited very high satisfaction level with a lower percentage about 20% being unsatisfied with the quality of data produced by the system.

Under sampling issues, the study established that in general, over 70% of the respondents had high level of satisfaction.

The study further made observations on standard procedures, which was discovered that around 50% of the respondents showing high or favorable satisfaction level

The study also identifies data governances as another area of significances, and it is revealed that most respondents about 80% had low or unfavorable perception concerning data governance procedures.

Despite the fact that a majority of the respondents perceived very good perception and satisfaction, did not mean there were no challenges. Some respondent identified some challenges that interfered with the accessibility of data. Key among the challenges

identified had to do with time and resources. Some of the respondents complained about time allotted for training on data collection. Moreover respondents raised issues of insufficient time allotted for data collection. Other respondents also stated that the logistics provided for data collection were not enough.

In addition, the study found improved effectiveness and efficiency as the driving reasons for the system. A majority of the respondents were of the opinion that the system is both effective and efficient.

## **5.2 Conclusion**

Furthermore, for a national agricultural statistics system to be viable, the data should be useful to the interested parties at the various levels of the system. In considering this, the Ghana Agricultural Production Survey (GAPS) will facilitate the district level officers to employ data for planning or designing, monitoring, assessment and evaluation. This will guarantee the information is communicated and utilized at the local level and a complete response loop is created involving the districts, Regions and national echelons.

For instance data on the incidence of the fall army worm on maize may be of good use to stakeholders of agriculture in areas where the worm infestation has been found in order to facilitate the design, planning implementation monitoring and evaluation of intervention to combat the effect of the pest.

The results of the study corroborates most of the research findings cited earlier, similarly it refutes others. From the results of the enquiry, the following conclusions are made.

The objectives of the study was to examine the perception and satisfaction of respondents on the usefulness of the integrated data management system, to identify the challenges involved in accessing these data and to explore means of improving accessibility and quality of these data.

As part of the measures to address the challenges, respondents recommended some improvement in the data management system. Many of the respondents were impressed with the quality of most parts of the system, they were equally impressed with other structural and process factors. Another important conclusion from the study is that

respondents were also comfortable with sampling procedures employed, this conclusion was based on the findings. Also the researcher observed that respondents were happy with most aspects of the system and expressed their interest by asking questions and making meaningful contributions.

However, some respondents expressed concerns about the challenges they face in using the system. It can be concluded that some respondents were not happy with some of the issues in the system. Poor governance and standards were some of the major issues identified as challenges to utilization of the system. Insufficient time and inadequate logistics were also some of the challenges identified.

Beyond the system level challenges were inadequate financial resources, community sensitization and public education.

However, these challenges could not have a complete influence on the thought of respondents.

Nevertheless, significant improvement is still required at the various levels of the system.

### **5.3.1 Recommendations and Mechanisms**

Based on the findings and conclusions outlined above, the subsequent suggestions and mechanisms to improve access of Agricultural data were made.

Notable among the challenges that fetter effective data management which the study unveiled was time allotted for training of data producers, the time given for the collection of agricultural data and the logistics provided for the field duties.

Further attention is required at the stage of training on the collection of data, there is a need to increase the time for training from the initial two weeks to four weeks which would include more field work for the trainees to become more used to the survey instrument (questionnaire). Couple with latest or refresher training of officers in Basic statistics, data management and computer literacy, the advantage of this that it will assist them resolve most of the errors observe, which could have been avoided at this point of the process.

Increasing the sample size, the creation of a least set of main data to be provided four yearly to fulfill latest and evolving needs, and by reviewing the six months schedule to collect data to twelve months in order to aid officers to collect quality data.

The provision of adequate logistics like durable motorbikes, more human and financial resources and the use of modern devices such as Remote sensing GIS, Mobile phone, social networking will enhance the robustness of the data collection process.

The provision of quick computer aided data checks, enhanced computer centered and personal focused supervision strategy, consistent data capture in the districts and speedy transmission of raw data to a common location for data processing will guarantee good quality data.

Integrating Agriculture into the National Statistical system by employing a set of procedures that incorporate the establishment of a master sample frame for the collection of agricultural data and through governance and statistical capacity building as a building block that would support the continuity of Agriculture statistics system.

The protocols used for data cleaning and office editing need to be reviewed and the processes use to collect data at the district level has to be assessed. The reason is that several issues on data collection at various stages of the survey were discovered. It is however expected that a careful revision of the procedures will support the flexibility needed with the application of data in every situation.

These suggestions are very crucial in assisting users to measure the strength, quality and consistency of the data. The final result of this is to improve the effectiveness of the information the survey offers for all interested parties.

If every stakeholder, including those collecting the information recognized the usefulness in the collection of data and turn it into good use, their request for quality data will be increased. This increased need for timely, quality, raw data beginning from the basic level will assist the improvement of national agriculture statistics system.

As part of the measures to address the challenges identified, some respondents recommended that apart from refresher training for field officers on data management, they should be more community sensitization and public education on the importance of agricultural data, as a measure to reduce the negative effect of community members.

As part of measures to improve access and quality of Agricultural data, The Ghana Census of Agriculture 2016-2019 recommends that public awareness should be intensified, Officer should be provided with adequate logistics.

Others suggest more financial support should be made available for respondents as a boost to their moral to increase their commitment in work. It was also needful that more advertising and promotion of Agriculture data managements systems should be done.

Therefore, identifying the challenges and recommending possible solutions to the challenges identified was a step in the right direction.

One key factor that cannot be left is stakeholder collaboration. Since improvement in utilization and quality of any system requires a multi-sectorial collaboration, it is prudent to bring all the stakeholders on board. Ensuring community participation and intensifying community awareness and public education will have a significant impact on the success of the system.

On the contrary, if nothing is done about the current situation, the sustainability of the good aspect of the system may not be guaranteed. To achieve a sustainable system will require closed monitoring and evaluation of the system, the monitoring and evaluation program of the system should be revived and strengthen.

Moreover, periodic training programs should be instituted for staff to strengthen their skills and update their knowledge. Provision of adequate resources and logistics couple with motivation of staff will cause considerable improvement in accessing agricultural data.

### **5.3.2 Areas for Further Research**

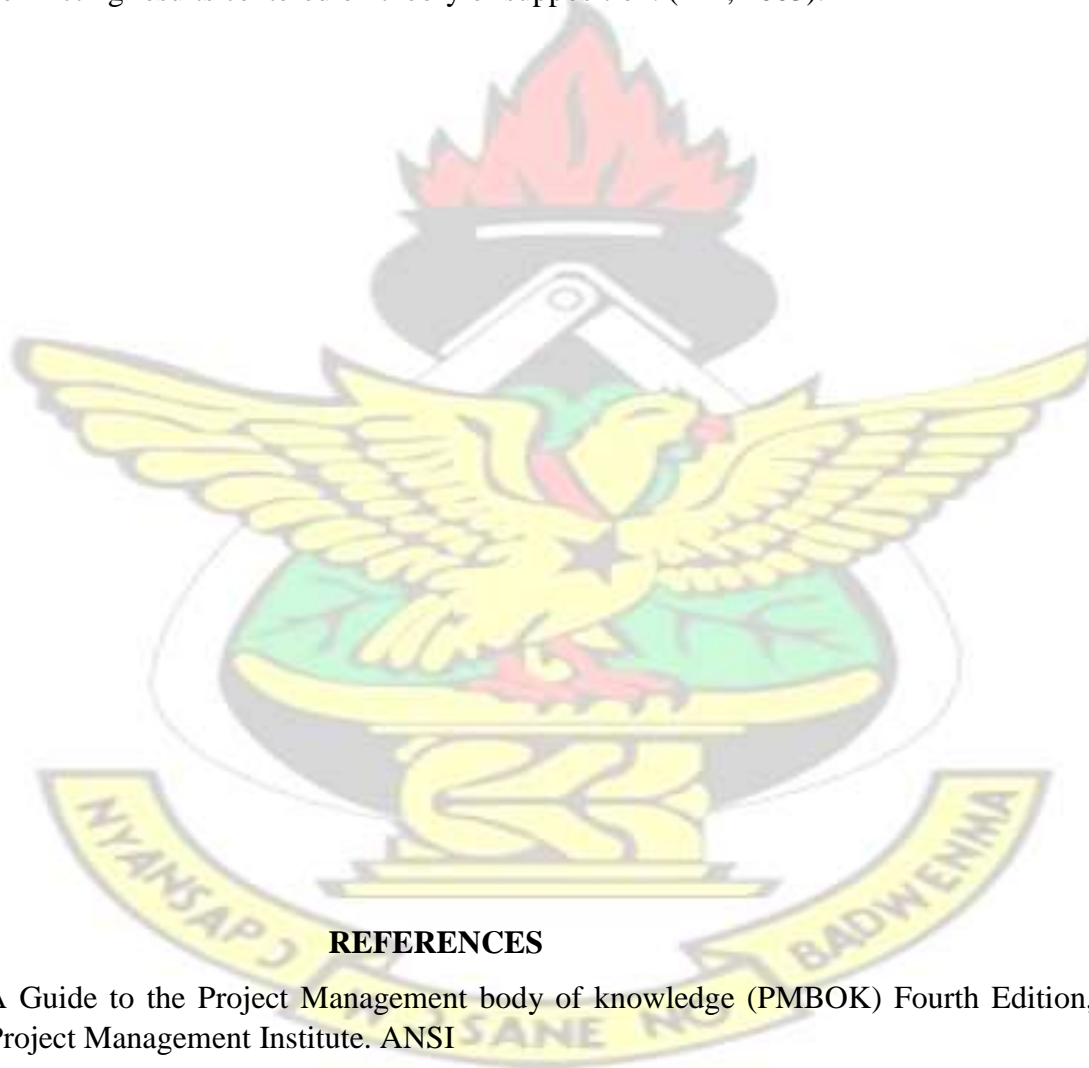
The current study examined Increasing access to Agricultural data using an integrated data management approach. The following recommendation for further studies were provided.

- 1 A replication of the study should be carried out using other stakeholders like Agriculture data users. In such a study two sets of instruments should be used, focus group interview schedule and a set of questionnaire should be used as the main

instruments, this is hope will provide a more in-depth study into issues relating to Agriculture data access.

2 A similar study to compare the differences in effectiveness between two cases, the Ghana Agricultural production survey and Ghana Census of Agriculture.

This is because studying multiple cases permits the investigator to delve into the discrepancies that exist within and across cases. The purpose is to repeat the findings between cases. Since contrasts will be made, it is essential that the cases are selected wisely such that the researcher can forecast like findings among cases, or envisage conflicting results centered on theory or supposition. (Yin, 2003).



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## APPENDICES

### A: QUESTIONNAIRE

Introduction to Respondents.

The question that you are to complete forms part of a research being conducted on the Topic: Improving Agricultural Data Access Using An Integrated Data Management Approach. (Case Study of The Ghana Agricultural Production Survey 2013) A thesis submitted to the department of computer science in partial fulfillment for the Award of Master of Science in Information Technology

You are kindly requested to read through the questions and respond to them as frankly and objectively as possible. Your responses will be treated as confidential and will use solely for academic purpose.

However, I count on the responses at your earliest convenience.

Thank you.

Abanga Anaba.



## SECTION A

Please tick [, appropriately on the space provided

### PERSONAL/DEMOGRAPHIC DATA OF RESPONDENTS.

#### Q1 Region

1 Ashanti [  ]

6 Greater Accra [  ]

2 Brong-Ahafo [  ]

7 Volta [  ]

3 Central [  ]

8 Northern [  ]

4 Eastern [ ]

9 Upper East [ ]

5 Western [ ]

10 Upper West [ ]

Q2 District

1 Adansi North [ ] 7 Assin North [ ] 13 Keta [ ]

2 Ejura [ ]

8 Atiwa [ ]

14 North Dayi [ ]

3 Offinso North [ ]

9 Kwahu North [ ]

15 Gonja Central [ ]

4 Techiman [ ]

10 Bia [ ]

16 Kpandai [ ]

5 Asunafo North [ ]

11 Jomoro [ ]

17 Bongo [ ]

6 Mfantiman [ ]

12 Ga East [ ]

18 Nadwoli [ ]

Q3 Gender

1 Female, [ ]

2 Male, [ ]

Q4 Age group (Years)

1 (21-30) [ ]

2 (31-40) [ ]

3 (41-50) [ ]

4 (51-60) [ ]

Q5 Academic qualification

1 Certificate [ ]

2 Diploma [ ]

3 1<sup>st</sup> degree [ ]

4 2<sup>nd</sup> degree (masters/PHD) [ ]

Q6 Working Class.

1 Technical [ ]

2 Sub- professional [ ]

3 Professional [ ]

Q7 Working experience in Agricultural data management (years)

1(1-10) [ ]

2 (11-20) [ ]

3 (21-30) [ ]

(31-40) [ ] SECTION: B I

4

RESPONDENTS PERCEPTION ON THE RELEVANCE OF AGRICULTURAL DATA.

DIRECTION: For the following items Q8 to Q 43, Please, read each item carefully and select the response which best expresses your idea about each statement by ticking [√] in the space provided.

Item No.	Perception Statement	Very True	True	Untrue	Very Untrue
Q8	My observation is that Agricultural data is important for decision making				
Q9	My view is that the emerging issues should be put together to seek solutions to the problems of Agricultural data integration				
Q10	My notion is that Agricultural data can be effectively integrated for decision making				
Q11	My convection is that Agricultural data lead to effective decision making and policies at district regional and national levels				
Q12	My impression is that the major solution to the problem of Agricultural data access is to promote integration				
Q13	My understanding is that the provision of quality is an enhancement to the Agricultural data access				

Q14	My belief is that it is possible to devote time to Agricultural data collection.				
Q15	My position is that Agricultural data collection should form an integral part of every Agricultural organization.				

## SECTION B II

People have different opinion about access of Agriculture Data. Here is a list of ideas that some people have expressed towards Agricultural data access. You will agree with some of them and disagree with others. Sometimes, you will agree strongly with a given statement. Read each of these sentences carefully then tick [√] by it in the column which best matches the option for your choice (Once again you are reminded of the confidentiality of your responds).

To what extend do you agree or disagree with the following statements concerning the implementation of the integrated data management system (The Ghana Agricultural Production Survey 2013) in accessing Agricultural data in Ghana.

	Satisfaction	Strongly agree	Agree	Disagree	Strongly disagree
ItemNo.	QUALITY AND ACCESS				
Q16	Increased data accuracy				
Q17	Increased data consistency				
Q18	Increased data completeness				
Q19	Increased data timeliness				
Q20	Higher coverage				
Q21	Higher disaggregation (geographic, Gender etc )				

Q22	There are process in place to for verifying the validity and reliability of data collected				
Q23	There are agreed strategies for data quality assurance				
Q24	The system produces an appropriate set of indicator to access data				
Q25	Data are stored /archived, so that it can be access by users.				
Q26	Data is produced , using advance technology like GPS				
<b>SAMPLING</b>					
Q27	Sampling frame is adequate				
Q28	Sampling method is accurate				
Q29	Sampling design is consistent to Research objectives				
Q30	Sampling errors are correctly assed				
<b>STANDARDS</b>					
Q31	Sound statistical concepts are used				
Q32	There are strategies for reconciliation of data				
Q33	There are strategies for harmonization of data				
Q34	Data is produced according to international acceptable standards				
<b>DATA GOVERNANCE</b>					
Q35	There are existing statistical legislation in place				
Q36	There are mechanism in place for consultation between producers and users				

Q37	The existing legislation and institutional frame work adequately to reflect the mandate for collection of Agricultural statistics				
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## SECTION C, CHALLENGES

The following items are to obtain respondent's understanding about the challenges associated with the Ghana Agricultural Production Survey (2013). Please Tick [] on the space which is appropriate to your understanding.

**Q 38.** Is the time allocated to the data collection sufficient?    A) Very sufficient, []  
 B) Sufficient, []    C) Not sufficient, []

**Q39.** Is the time allocated to the Training on data collection sufficient?    A) Very sufficient, [] B) Sufficient, [] C) Not sufficient, []

**Q 40.** Are the logistics provided for the data collection enough?  
 A) More than enough, []    B) Enough, []    C) Not enough. [] **Q41**

What is your opinion about the effectiveness of the system?  
 A) Very effective []    B) Effective []    C) Not effective [] **Q42**

What is your opinion about the efficiency of the system?  
 A) Very efficient []    B) Efficient []    C) Not efficient []

Thanks for sacrificing your precious time.

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