A REVIEW OF
THE NATIONAL AGRICULTURAL INFORMATION SYSTEM IN MOZAMBIQUE

by

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The intent of the discussion paper series is to stimulate and exchange ideas on issues pertinent to the economic and social development of Mozambique. A multiplicity of views exists on how to best foment economic and social development. The discussion paper series aims to reflect this diversity.

As a result, the ideas presented in the discussion papers are those of the authors. The content of the papers do not necessarily reflect the views of the Ministry of Planning and Development or any other institution within the government of Mozambique.

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Acronyms

CAP	:	Censo Agro-Pecuário Census of Agriculture and Livestock
CEPAGRI	:	Centro de Promoção da Agricultura Comercial Centre for Commercial Agriculture Promotion
DE	:	Direcção de Economia Directorate of Economics
DNAIS	:	Department of National Agricultural Information Systems Departamento Nacional de Sistemas de Informação Agrária
DNEA	:	Direcção Nacional de Extensão Agrária National Directorate for Agricultural Extension
DNSA	:	Direcção Nacional de Serviços Agrários National Directorate of Agricultural Services
DNSV	:	Direcção Nacional dos Serviços Veterinários National Directorate of Veterinary Services
DPA	:	Direcção Provincial de Agricultura Provincial Directorate of Agriculture
DSE	:	Direcção Distrital de Serviços Económicos District Directorate of Economic Services
EAs	:	Enumeration Areas Áreas de enumeração
FAO	:	Food and Agriculture Organization of the United Nations Organização das Naçõe Unidas para Alimentação e Agriculture
FEWS	:	Famine Early Warning System Sistema de Aviso Prévio para a Fome
FUE	:	Ficheiro de Unidades Estatísticas Directory of Statistical Units (business frame)
GNP	:	Gross National Product Produto Nacional Bruto
GPS	:	Global Positioning System Sistema de Posição Global
IAF	:	Inquérito Agregados Familiares Household Budget Survey
IAM	:	Instituto de Algodão de Moçambique Mozambique Cotton Institute
IIAM	:	Instituto de Investigação Agrária de Moçambique Institute of Agricultural Research of Mozambique
INCAJU	:	Instituto de Caju National Cashew Institute
INE	:	Instituto Nacional de Estatística National Statistics Institute
MIC	:	Ministério de Indústria e Comércio Ministry of Industry and Commerce
MINAG	:	Ministério de Agricultura Ministry of Agriculture
MPD	:	Ministério do Plano e Desenvolvimento Ministry of Planning and Development
MSU	:	Michigan State University Universidade Estatal de Michigan

NAIC	:	National Agricultural Information Committee
		Comité Nacional de Informação Agrária
NDVI	:	Normalized Difference Vegetation Index
		Index Normalizado de Diferença Vegetativa
NGOs	:	Non-Governmental Organizations
		Organizações Não-Governamentais
PARPA	:	Plano de Acção para Redução da Pobreza Absoluta
		Action Plan for the Reduction of Absolute Poverty
PES	:	Plano Económico Social
		Economic and Social Plan
PHC	:	Population and Housing Census
		Recenseamento Geral da População e Habitação
PROAGRI	:	Programa Nacional de Desenvolvimento Agrário
		National Programme for Agricultural Development
SETSAN	:	Secretariado Técnico de Segurança Alimentar e Nutricional
		Technical Secretariat of Food and Nutrition Security
SIMA	:	Sistema de Informação de Mercados Agrícolas
		Agricultural Market Information System
TIA	:	Trabalho de Inquérito Agrícola
		National Agricultural Survey
USAID	:	United States Agency for International Development
		Agência dos Estados Unidos para o Desenvolvimento Internacional
WRSI	:	Waters Requirements Satisfaction Index
		Index da Satisfação das Necessidades em Água

Summary

The evaluation of the current base of agricultural statistics in the Ministry of Agriculture (MINAG) leading to the design of a methodological approach for the future is a study that was requested by many government agencies, donors, non-governmental and research organizations. The current state of agricultural statistics is characterized by a polarization. On one end, there is a database of statistical information obtained through sample surveys TIA (*Trabalho de Inquérito Agrícola*) that uses a universally accepted methodology, but the information is not available in a timely fashion. On the other end, forecasts of crop production, estimated using a different methodology, are generated regularly and available in a timelier manner through the Early Warning System *(Aviso Prévio)*. Users of agricultural statistics therefore turn to one or the other source of information to address the same issues, resulting in situations where different numbers are used to represent the same indicator for the agricultural sector. The problem becomes more glaring when the different sources show huge discrepancies in their estimates and trends as they did in 2005 when cereal production was estimated at 1,900,000 tons by *Aviso Prévio* compared to 1,137,000 tons by TIA, a 67% difference. The objectives of the study are to:

- Provide a detailed description and in-depth analysis of the current state of the sub-system of agricultural statistics, identifying the principal sources of statistical information within and outside of MINAG.
- Provide an assessment of the quality of the statistics, identifying their strengths and weaknesses and based on this assessment, give recommendations on how to improve upon the current state.

The study involved a review of key documents including government policy documents, reports on previous assessments e.g. by FAO, questionnaires, survey manuals and survey reports (where they existed) and bulletins. Various interviews were carried out among officials mainly in government. In addition, the Province of Gaza was visited followed by Chókwe District.

The main sources of agricultural information are concentrated within the Ministry of Agriculture (MINAG) – in the Directorate of Economics (DE) which undertakes the annual agricultural survey (TIA) and the Agricultural Market Information System (SIMA), and in the National Directorate of Agricultural Services (DNSA) which undertakes the *Aviso Prévio*. Also under DNSA are the Technical Secretariat of Food Security and Nutrition (SETSAN) and the Famine Early Warning Systems (FEWS) NET.

TIA has been conducted in 1996, 2002, 2003, 2005 and 2006. The two basic objectives of TIA are: to collect data on agricultural production, area cultivated and livestock; and to collect data on indicators for use by the PROAGRI and the PARPA. The TIA questionnaire each year is adapted with input from the main data users at the Ministry of Agriculture to ensure that the needs for data analysis are being met. In 2002 and 2003, 80 districts out of 138 were sampled for TIA. Starting in 2005, the sample was increased to 94 districts. The end result was an increase in the number of small and medium households interviewed from 4,935 (2003) to 6,248 (2006). Also for the 2006 TIA all data entry was completed in the field. The TIA data collection methodology includes the use of GPS equipment for measuring the farm size and area planted in crops, as well as measuring tape and compass for measuring smaller plots. The production data are dependent on respondent recall. The nature of recall bias is an area that needs to be studied further, but in the case of crops that are sold, the farmers appear to provide more accurate information. Training of survey staff is given high priority. The quality of data is compromised by the length of the questionnaire and the dependency on recall. One of the main issues in respect to TIA is the lack of timeliness.

In order to provide crop forecasts, the Department of Early Warning undertakes a Crop Forecast Survey (*Aviso Prévio*). Data are supposed to be collected from 24 sample farms in 3 sample districts in all 10 provinces. These procedures are not always followed due to funding timing and availability and staffing at the District level. *Aviso Prévio* indicated that the end of FAO assistance in 2000 created a dependency on Government for funding. Funding at all levels is a continuous issue. Results from *Aviso Prévio* are produced in a timely manner. It is for this reason that they are used by the Ministry of Planning and Development (MPD) for the evaluation of the Economic and Social Plan (PES) even when they are known to be preliminary.

Different Units in the Ministry using different methods for data collection naturally affects data consistency on the same agricultural indicators across Units. For purposes of data consistency and comparability, the same methods e.g. sampling and weighting methods need to be used for *CAP*, *TIA* and *Aviso Prévio*. This is not happening and hence the lack of consistency in agricultural data produced by different Units.

Having different Units within MINAG undertake different agricultural statistics activities is not the most efficient way to utilize resources. First, there is overlap in the information collected. Secondly, available resources including manpower and financial are duplicated and spread thin across Units. Thirdly capacity building and sustainability issues become elusive when the function for statistical information is parceled. Fourthly, there is no common inter-institutional/agency oversight committee to vet the estimates produced. Fifthly, the exercise of statutory oversight and technical backstopping by INE becomes difficult when data collection activities are undertaken by different Units that are not under the Department of Statistics.

Recommendation - Institutional Re-alignment

1. The most important step that needs to be undertaken is to re-align the all the agricultural statistical gathering entities by placing the major statistical activities under the Directorate of Economics. This has a number of advantages including making it easier for INE to exercise its mandated oversight over the statistical work of the Ministry. These recommendations are sequenced in relation to the amount of political will required to bring about change:
   - The Department of Statistics fulfills its mandate from INE by approving all statistical activities and is the sole official source of information from MINAG;
   - A **Department of National Agricultural Information Systems (DNAIS)**, formerly know as the Department of Statistics is created under the Directorate of Economics;
   - A **National Agricultural Information Committee (NAIC)** chaired by the MINAG Permanent Secretary is formed to oversee the development of the national agricultural information system, approve crop forecast estimates and advise government on food status in the country;
   - A **Technical Committee for NAIS (TCNAIS)** is created that overseas all technical and operational matters;
   - The DNAIS should provide the secretariat for the Technical Committee as well as the NAIC;
   - Both TIA and *Aviso Prévio* are placed within NAIS and merged to form an Agricultural Survey Unit in order to achieve synergy, efficiency, cost-effectiveness and credibility in agricultural statistics; and
   - SIMA remains as a separate unit under NAIS.
2. As a Secretariat, SESTAN should not be involved in data collection from primary sources i.e. households. Rather, it should be collating data from secondary sources such as INE, Ministry of Health, etc. Where required data are not available, it should urge for their collection. FEWS NET should remain a unit under SESTAN.

3. In the longer term, the integration should be extended to all departments that collect data in the Ministry of Agriculture by subsuming them under one directorate, a Directorate of Agricultural Information.

Recommendations - Methodology, Resources, Data Quality and Dissemination

1. A more continuous survey methodology should be adopted throughout the year. The Aviso Prévio and TIA should be integrated starting with the sampling frame and estimation methodology; a survey calendar should be established for the timely release of results from early warning crop forecasts to final crop production estimates.
2. Methodologies should follow international best practice, be properly documented and followed in the field as much as possible.
3. The methodology for *Aviso Prévio* should be reviewed.
4. The strong leadership of INE should be used in the development of the vision to create an information culture that extends to individuals by reaching the lowest administrative levels through a community-based interactive information system.
5. The survey samples should be redesigned after the Population and Housing Census in such a way that areas with concentrations of large livestock are over-sampled for purposes of getting more reliable livestock data.
6. Special surveys should be undertaken to estimate: fruit and nut production, vegetable production mainly in urban and peri-urban areas, cost of production and in-land fish catch and characteristics of fishermen.
7. In order to align the *Aviso Prévio* and TIA methodology and rationalize the use of resources for the agricultural sampling frames it is recommended that a systematic approach be used for developing and maintaining a unified directory of large and commercial farms that would then be available for all surveys.
8. A greater investment should be made to develop capacity for statistical production and use.
9. There should be an increase in operational resources, budgets and logistics at all levels.
10. In order to provide the Department of Statistics with more qualified personnel, a plan for training the existing staff as a continuing activity and recruitment of additional staff should be considered a priority.
11. Funds for undertaking all national agricultural information activities should be provided centrally.
12. It is recommended that the methodologies for data collection should be reviewed taking into account the experience so far gained in planning and management of surveys.
13. Every effort should be made to keep the TIA survey questionnaires short; a more comprehensive TIA with a socioeconomic component should be conducted about once every 3 years.
14. More intensive training and supervision of field staff should be done to improve the quality of field data.
15. It is important to tabulate the sampling errors for the most important estimates.
16. Statistical reports should be written for TIA results each time the survey is conducted.
17. It is important to strengthen the capacity of the staff for data analysis in order to improve the utilization of the data for policy-making.
18. A user-friendly and accessible agricultural database should be designed.
19. To the extent possible and learning from dissemination of agricultural price information, extensive dissemination of all agricultural data should be made.
20. An integrated calendar of survey activities for the Aviso Prévio and TIA should be based on the agricultural calendar and the timing of key survey results needed by data users, including the Food Balance Sheet. An example of such a calendar is presented in Annex X. The timetable for conducting TIA should be revised so that results can be made available in good time for use in the evaluation of the Economic and Social Plan (PES).

1. Background

1.1 Role and Importance of Agriculture to the National Economy

As a sector and an activity, agriculture plays a dominant role in the lives of the people of Mozambique. It is a major source of livelihood for the majority of the population (80% of households involved in the sector), it contributes up to 22% of the Gross National Product (GNP) and it constitutes a major source of revenue and foreign currency earnings for the country. Agriculture is practiced not only by rural populations but also by some households in urban and peri-urban areas. It has been said that economic growth and poverty alleviation in Mozambique are practically impossible to achieve without sustainable development of the agriculture sector.

Many parts of the country have excellent conditions for agriculture, enabling the cultivation of a great variety of crops such as maize, sorghum, millet, rice, cow peas, groundnuts, beans, cassava, coconuts, cashews, tea, sugar cane, cotton, and many types of fruits. The main food crops are cassava and maize. A large proportion of households grow both crops. However, the relative importance of the two crops varies across the country. In some parts of the north of the country, cassava is the main crop; in the center and south maize is the main crop. Most households also grow one or more leguminous crops principally cow peas and groundnuts. A large proportion of the smallholders practice growing crops in association with some tree cover. The main export crop is cashew nuts, followed by copra, cotton and tobacco[1].

Results from the 1999/2000 Census of Agriculture and Livestock (*Censo Agro-Pecuário* - CAP) and various rounds of **National Agricultural Survey (*Trabalho do Inquérito Agrícola* – TIA)** show that smallholders constitute the backbone of the agricultural sector. It is estimated that there are over 3 million such smallholders in the country. Smallholders carry out rain-fed agriculture, operate at low levels of productivity and are vulnerable to adverse climatic conditions and natural disasters such as cyclones and flooding. The structure of agriculture has changed little since independence. Before independence farms, both large and small, owned by Portuguese represented a major part of the commercial sector. With their almost complete exodus, the Government was forced to take over the abandoned farms, transforming them into state-owned or state-operated enterprises. The civil war started shortly after independence. This war together with the effects of drought and floods caused a serious decline in agricultural production and in particular the loss of livestock. Large farms account for approximately 2% of the agricultural land use. However, there is some indication that there is growth in the commercial sector and medium size farms are on the increase.

Most of the smallholder production is for own consumption. There has however been a considerable growth in the marketing of both basic food crops and cash crops since the Peace Accord in 1992. Mozambique is a major producer of cashew and coconut products. Most of this is produced by the smallholder sector. The level of exports devastated by the war is now recovering. Food security has been a serious problem. The south of the country is particularly vulnerable to either drought or flooding.

Livestock has traditionally been very important in Mozambique especially in the drier south and the two interior provinces of the centre. Livestock numbers have been recovering rapidly. Animal traction is also important and on the increase, but is largely limited to the central and

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[1] *Main Census Report, Volume 1 of Census Reports, Instituto Nacional de Estatistítica, Maputo, Mozambique, September 2002*

southern parts of the country. The main types of livestock are cattle, goats, pigs and chickens[2].

1.2   Need for Agricultural Data and Information

The Government's overarching development goal has been to reduce the incidence of absolute poverty from 70% in 1997 to less than 60% by 2005 and to less than 50% by the end of this decade. In this connection, the Government in 2001 adopted an **Action Plan for the Reduction of Absolute Poverty (PARPA), 2001-2005** and a public sector reform programme. There is now a second generation PARPA (PARPA-II) which aims to reduce the percentage of the population living below the poverty line from 54 per cent (the figure found by the 2003 Household Survey) to 45 per cent by 2009. The new plan maintains the same priorities as PARPA-I in developing human capital, in education and health, in improving governance, in developing basic infrastructure, and in improving macro-economic and financial management. Where it differs from the earlier plan is in including greater integration of the national economy, focusing its attention on development at district level, and on creating a favourable environment for growth of the productive sector - particularly small and medium companies.

In 1999, Government adopted a comprehensive sector-wide development programme, **National Programme for Agrarian Development (PROAGRI)** aimed to contribute to poverty reduction and improved food security. The specific objectives are: i) to support smallholders to develop their agriculture and natural resource related activities; ii) to stimulate increased agricultural and natural resource based production and development of agro-industries for domestic and export markets; and iii) to guarantee sustainable natural resources management and conservation that takes into account community, public sector and private sector interests.

Evidence-based policy and decision-making which now guides policy and programming in government, requires that public policy decisions are supported by careful and rigorous analysis using **sound and transparent data**. This is important as it enhances the transparency of policy-making, helps avoid sectional interests in public policy management and decision-making, provides some assurance for taking rational decisions, and it enhances the accountability of policy and decision-makers. Huge amounts of statistical data and information on all aspects of the agricultural sector and rural population are required to elaborate the development processes in the country. In particular, agricultural data and information are required to:

- underpin the planning processes;
- compile national accounts;
- inform public policy analysis, debate and advice;
- observe sector performance;
- monitor and evaluate the impact of policies and programmes; and
- enlighten the decision-making processes.

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[2]   *Ibid*

1.3 Need for the Study

The Ministry of Agriculture (MINAG), through the Directorate of Economics, has delegated authority from INE to produce official agricultural statistics. For such statistics to support the national development process as outlined above, they should be comprehensive, complete, accurate, consistent (both across sources and in time) and timely. In addition, the devolution of planning function from the centre to districts (decentralization) and the need for undertaking operations within districts such as disease control, has created great demand for highly disaggregated data down to district and sub-district levels.

Great concern has been raised in various forums by key stakeholders about agricultural statistics in the country. On the one hand, one directorate of the ministry undertakes a sample survey (TIA) to collect agricultural and related data. The survey data lack timeliness due to operational reasons and are not highly disaggregated (are disaggregated only down to provincial level). In addition, the data are not widely published and disseminated and thus, potential users of the data (internal or external to MINAG) have limited access to them. On the other hand, forecasts of crop production, estimated using a different methodology, are generated regularly and made available in a timelier manner through the Early Warning System (*Aviso Prévio*). These forecasts are used in the calculation of production statistics and although they are classified as "*preliminary*", they are used by the Ministry of Planning and Development for the evaluation (*balanço*) of the Economic and Social Plan (PES). The PES for the next year is developed around September together with the national budget, and the evaluation of the PES for the previous year is conducted in March/April. For the National Accounts INE relies on the TIA results for most crops, but they also use other sources including Aviso Prévio for particular products. Another issue is that the Annual Statistical Abstract (*Anuário Estatístico*) of INE is produced in March, so it has only been including the crop production estimates from Aviso Prévio in recent years. Users turn to one or the other source of information to address the same issues, resulting in situations where different numbers are used to represent the same indicators for the agricultural sector. The problem becomes more glaring when the different sources show huge discrepancies in their estimates and trends.

It is against this backdrop that in close collaboration with the Ministry of Planning and Development, INE and other key stakeholders, the Ministry of Agriculture decided to have a study undertaken to:
- provide a detailed description and in-depth analysis of the current state of agricultural statistics, identifying the principal sources of statistical information within and outside of MINAG.
- provide an assessment of the quality of the statistics, identifying their strengths and weaknesses and based on this assessment, give recommendations on how to improve upon the current state.

The detailed terms of reference of the study are given in Annex I.

1.4 Study Team

A team, comprising Prof. Ben Kiregyera (agricultural statistician and team leader), Mr. David Megill (statistician), Mr. David Eding (agricultural economist) and Mr. Bonifácio José (statistician) undertook the study from 23 April to 7 May, working mainly in Maputo but also visiting Gaza Province (Provincial Agricultural Office and Chókwe district office) on 2 May.

1.5   Methodology

The study involved a review of key documents including government policy documents, reports on previous assessments e.g. by FAO, questionnaires, survey manuals and survey reports (where they existed) and bulletins. Various interviews were carried out among officials mainly in government. In addition, the entire evaluation team supported by four professionals from MINAG visited the Province of Gaza followed by Chókwe District to obtain a clear picture of the relations between administrative levels in view of decentralization of government with the District as the operational base. The full list of officials met is given in Annex II. An analysis of TIA and *Aviso Prévio* datasets was also done.

1.6   Organization of the Report

This report has three sections. **Section 1** provides a general background that includes the importance of agriculture to the national economy, role of data in the development of the agricultural economy, state of agricultural statistics in the country, terms of reference and the methodology for undertaking the study. **Section 2** presents main findings while **Section 3** presents main conclusions and recommendations. The list of documents accessed is given under references.

2. Main Findings

This section presents the main findings of the study in terms of demand for data, institutional and organizational issues, key players in the agricultural statistical system, main sources of data, capacities to collect and manage data, methodologies for data collection and their documentation, data quality issues and their implications, and data dissemination and usage.

2.1 Demand for Agricultural Data

The demand for statistical data and information about the agricultural sector has increased dramatically over the past few years. The demand is coming from a wide spectrum of stakeholders and for various uses including the following:

Government

Government is the main user of agricultural data. There is increasing demand for agricultural data among policy decision-makers and analysts for:

(a) **upstream roles**: These include highlighting issues to be addressed by policy interventions including establishing baselines required for the effective implementation and monitoring of the impact of policies, development strategies and interventions, and informing policy choice and programme design such as the PROAGRI and poverty reduction such as PARPA.

(b) **downstream roles**: These include measurement, monitoring and evaluating performance of policies and programmes (or lack of it) and reporting on progress i.e. achievement of outputs and outcomes/impact of policies and programmes. The impacts of the policy actions and programmes are measured through prior-accepted and specified indicators.

Private Sector

The private sector or economic agents such as business enterprises, associations and trade unions are demanding and using more agricultural data to assess business opportunities, risks and prospects; planning, decision-making, monitoring and evaluation; and for reporting on business activities. For instance, traders use statistics to determine where to buy and sell products and to take critical investment decisions. Traders want to know the price of produce at the farm and in the market before they decide to buy.

Non-Governmental Organizations

Non-Governmental Organizations (NGOs) are voluntary organizations that work for specific causes, mainly humanitarian in nature. They work with and among targeted communities – e.g. rural poor, women, the disabled, children, the displaced, etc. They need and use a lot of agricultural and other statistics to plan, implement, monitor and evaluate their activities. They also use statistics to report back to their headquarters.

Research and Training Organizations

Researchers, academicians, policy analysts, data analysts and subject-matter specialists in research centres and Universities use agricultural data for research and analysis, and as teaching aids. For instance, the Institute of Agricultural Research of Mozambique (IIAM) has used national agricultural survey data extensively to set priorities for public sector agricultural research[3]. Also an extensive analysis of rural incomes in Mozambique has been done by academicians using data from TIA[4].

Farmers

Farmers also need data to make informed decisions. For example, farmers need market information to determine whether it is worthwhile taking their produce to the market, check on the price they are receiving vis-à-vis prevailing market prices, to decide whether or not to store produce in anticipation of price changes, decide whether to grow different crops, etc.

Sub-regional Organizations and International Organizations

Sub-regional organizations such as SADC to which Mozambique is a member, use statistics to support the economic integration process and reporting. International organizations such as those of the United Nations and donor agencies (multilateral and bilateral) use agricultural data to assess requirements for assistance and/or participation in development initiatives and to evaluate the effectiveness of the assistance.

The Wider Public

The wider public use agricultural data for making individual decisions and assessing the performance of Government, and for a variety of other purposes.

2.2   Data Supply

2.2.1   Organizational and Institutional Issues
(a)   Authority to Collect Data

The Statistics Act (Law No. 7/96) bestows on INE the responsibility for the collection, production and dissemination of official statistics in the country. INE has power to delegate some responsibility to those government ministries and institutions it deems to have capacity to collect and publish official statistics including the Ministries of Agriculture, Health, Education, etc. It is under delegated authority that the Ministry of Agriculture produces and publishes official agricultural statistics.

However, delegation of authority enjoins INE to undertake regular statistics audits of the delegated institutions to ascertain that sufficient capacity exists and to backstop the institutions where necessary, and ensure that accepted methodologies and instruments are used to collect data and that the statistics produced by these institutions are brought to INE for approval before they are published as official statistics. This process needs to be strengthened in order to be more effective.

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[3] *Priority setting for public-sector agricultural research in Mozambique with national agricultural survey data, Research Report No. 3E by T. Walker, et al, Institute of Agricultural Research of Mozambique, Maputo, August 2006.*
[4] *Changes in rural household income patterns in Mozambique, 1996-2002, and implications for agriculture's contribution to poverty reduction, Research Report No. 61E by Duncan Boughton, et al, Institute of Agricultural Research of Mozambique, Maputo, August 2006*

(b) Who Produces Agricultural Data?

The main sources of agricultural information are concentrated within the Ministry of Agriculture (MINAG). Apart from the Census of Agriculture and Livestock (*Censo Agro-Pecuário* - CAP) which was undertaken by the National Institute of Statistics - *Instituto Nacional de Estatística* (INE) in close collaboration with MINAG, most agricultural data are produced by MINAG. Within the Ministry of Agriculture the two main Directorates that produce agricultural statistics are the Directorate of Economics (DE) and the National Directorate of Agricultural Services (DNSA). Presented as Annex III are the main Agricultural Data Sources.

Within the Directorate of Economics the Department of Statistics is responsible for the TIA as well as the Agricultural Market Information System (SIMA). The DNSA provides a forecast of crop production through their Department of Early Warning.

National Agricultural Survey (*Trabalho do Inquérito Agrícola* – TIA)

TIA has been conducted in 1996, 2002, 2003, 2005 and 2006. No survey was conducted in 2004 due to presidential and parliamentary elections. The two basic objectives of TIA are: to collect data on agricultural production, area cultivated and livestock; and to collect data on indicators for use by the PROAGRI and the PARPA. Periodically additional socio-economic characteristics are collected for more in-depth studies of the relationship of agricultural production of farm households and poverty status, and other issues related to policy analysis. The TIA questionnaire each year is adapted with input from the main data users at the Ministry of Agriculture to ensure that the needs for data analysis are being met. In 2002 and 2003, 80 districts out of 138 were sampled for TIA. Starting in 2005, the sample was increased to 94 districts. The end result was an increase in the number of small and medium households interviewed from 4,935 (2003) to 6,248 (2006). The increase in the number of districts sampled is a positive development.

The Directorate of Economics receives support from Michigan State University (MSU) under a grant from the United States Agency for International Development (USAID). MSU support includes 2 long-term advisors who are an integral part of the Directorate of Economics and the Institute for Agricultural Research in Mozambique (IIAM). The relation between the advisors and the Directorate is very good which has resulted in increased capacity to collect, process, analyze and disseminate information. TIA has an elaborate survey structure. For the last four rounds of TIA, the following survey management structure has been in place:

> President of TIA
> Survey Manager (Coordinator)
> Committees
> √ Methodology and Training - Chairperson plus all trainers (6)
> √ Data Management – 4 members tasked with designing data entry screens
> √ Operations – 2 or 3 members that handle budget and provincial coordination
> √ Logistics – 5 members that work on procurement of survey materials
> Technical Advisors – 2 (one national, one international expert from MSU)

To carry out the survey requires deployment of the following number of supervisory teams:
> MINAG – 1 to 3 supervisors in each province (25 total)
> DPA (Provincial Directorate of Agriculture) – 2 supervisors per province (20 total)

Due to staffing constraints within the Directorate of Economics, a few Supervisory personnel are drawn from other Directorates as well as hiring contractor staff, who are provided with appropriate training.

The above supervisors are responsible for the work of 49 survey teams. Each survey team includes a supervisor, 3 enumerators, a data entry clerk and a vehicle with driver.
The total number of field enumeration personnel is:

     49 – Team Supervisors
   147 – Enumerators
     49 – Data Entry Clerks (qualified as interviewers since they passed the test for enumerators; a separate test is also given for proficiency in data entry)

It is important to note that for the 2006 TIA all data entry was completed in the field. This included double entry of data, generation of an error list and review of results so that any inconsistencies can be resolved expeditiously in the field. This will also improve the timeliness of the availability of the clean data files that can be used for generating the priority tables on crop and livestock production and other indicators where the timing is critical. The TIA data collection methodology includes the use of GPS equipment for measuring the farm size and area planted in crops, as well as measuring tape and compass for measuring smaller plots. The production data are dependent on respondent recall. The nature of recall bias is an area that needs to be studied further, but in the case of crops that are sold, the farmers appear to provide more accurate information.

Training of survey staff is given high priority. The first step is to train all trainers for a period of one to two weeks. This is followed by the trainers conducting training at four training centers for a period of 12 to 16 days. During that time up to 7 tests (first implemented in 2005) are administered which must be passed to participate in the field exercises. Improvements are made frequently since emphasis is placed on gathering quality data.

The quality of data is compromised by the length of the questionnaire and the dependency on recall. In respect to the average length of time that the interview takes, it varies from an average of 69 minutes in 2006 (no income module) to 91 minutes (includes income module). There is always a need to balance the perceived need for information against what is actually required. The cost of the 2006 agricultural survey was approximately Mts. 21,000,000, or $792,000.

One of the main issues in respect to TIA is the lack of timeliness. The survey should start the first week in August in the South and 2 weeks later in the Center and North. In 2002 the schedule was adhered to, but for 2003, 2005 and 2006, field work did not start until September. The reason for the late start was the decentralization of funds to the Provincial Offices of Agriculture (DPAs) as well as late disbursements. The end result was that enumeration was not completed until December. For the upcoming 2007 TIA, training and data collection funds have been transferred to the Directorate of Economics. The issue of timeliness of resources necessary to carry out the survey is a major issue that must be solved. One of the main tests for TIA is whether or not survey findings will be available by the end of the calendar year. Most of the final TIA 2006 results were presented at a workshop in March 2007, although at the time of this evaluation, results had not been published. On the INE web site there are crop production tables with preliminary TIA 2006 results. There are also estimates for TIA 2004 which is misleading since no survey was conducted that year; these results are actually calculated based on the 2002, 2003 and 2005 TIA. It is imperative that results for the TIA are available for the evaluation of the PES and for tracking of and recommending performance-enhancing measures.

Agricultural Market Information

There are two main sources of market information. There is the Ministry of Commerce (MIC) and MINAG Agricultural Markets Information System (SIMA). MIC provides market information that meets the needs of traders (upstream), whereas SIMA meets the needs of farmers (down stream). MIC covers the later part of trade which involves wholesale prices from among larger traders and millers as well as current stocks.

MIC is one of the main users of early warning data. One thing that MIC noted is the overlap and lack of transparency with early warning data in respect to methodology. The process is also viewed as flawed because of the limited resources to collect data at the district level.

MIC collects prices for 20 food items (consumer price index basket) utilizing mainly provincial level staff as well as some staff at the district level. It also collects data from main millers and large traders (stocks and intention to export/import). To do this, MIC has weekly contact with provinces. MIC also uses data from *Aviso Prévio* on production of cassava, beans and other staples. MIC publishes a weekly bulletin. In order to disseminate price information widely, it publishes with MINAG a one-page fact sheet in the national newspaper every week and uses the radio and local languages to reach the largest number of users of price information. MIC also compiles a Food Balance Sheet in joint collaboration with MINAG.

SIMA collects market information from at least 20 major markets in the country. SIMA information is available in newspapers, and also SIMA publishes a weekly bulletin, available on the website. The database is available upon request, and SIMA data have been used for academic papers and theses. Methodological revisions occur to improve data collection, such as with roots and tubers. There are other rapid appraisal and market assessments completed by SIMA, as well, to complement the price information. With additional funding from Rockefeller Foundation, there are current efforts to enhance the provincial level systems, which provide the sort of information needed for key crops, in the local markets, for broadcasting on local radio stations. The TIA results since 2002 indicate that more than a quarter of the small and medium farm households receive market information from SIMA over the radio.

When comparing Jan.-Mar. 2004 to Jan.-Mar. 2005 major market price information from SIMA, there are some very interesting results. The average price of grain more than doubled from the 2003/04 to 2004/05 production (from 5.18 to 10.46) in Maputo. The change was even greater in Cuamba, where the price increased from 2.57 to 10.29 for the 2004/05 production year. Market price information supports the fact that the 2004/05 agricultural year was a deficit year.

There is a need to harmonize data and to combine efforts in relation to collecting both wholesale and retail price information. One of the greatest challenges for SIMA is to address the need for local price information down to the village level. How to gather, process and disseminate information at the lowest possible administrative level is important for the development of the farm sector. A good market price information system will benefit farmers in two ways by providing a reference point for negotiating prices with buyers and for determining when to sell.

During the course of this evaluation one of the key staff of SIMA who had received a master's degree from MSU was hired by the World Bank. It is imperative that the government retains key staff members if it is going to address important issues relating to providing timely, accurate, relevant and cost-effective information at lower administrative levels.

Aviso Prévio

In order to provide crop forecasts, the Department of Early Warning undertakes a Crop Forecast Survey (*Aviso Prévio*) which was designed around three field visits to sample farms. An overview of the *Aviso Prévio* methodology is described in Annex IV. The first visit in Dec.-Jan. is right after the planting of the crop to check crop progress, measure fields and select two 7-meter square plots for crop cutting. The second visit in Feb.-Mar. is scheduled to check the status of the crop. The third and final visit in Apr.-May is for crop cutting.

Data are supposed to be collected from 24 sample farms in 3 sample districts in all 10 provinces. Each year 3 new districts are selected in the *Aviso Prévio* sample for each province. Field data collection involves central, provincial and district personnel. The Department of Early Warning is staffed by 8 professionals that have a minimum of a first degree. The disciplines that are covered include Agro-meteorological, Agro-statistics, Economics, Planning and Agronomy. The Head of Early Warning indicated that there is sufficient staff in the central office to perform the functions of Early Warning. Emphasis was placed on the need to re-train personnel in order to keep them current.

At each lower administrative level, staffing becomes a bigger issue. The view from the Department of Early Warning is that there is also sufficient capacity at the provincial level. At the district level, however, there are real challenges in respect to trained agricultural staff. The issue of sufficient staff at the district level has been further complicated by the creation of the District Economic Services (SED) which does not specially address agriculture. In some districts there is not sufficient staff who understands agricultural information as it relates to Early Warning.

MINAG can only advise provincial and district administrations, which leads to a dependency on the districts to obtain the field data that is utilized for the crop forecast. Focus needs to be squarely placed on building the capacity at the district level. In general, there is a need to instill a greater appreciation of the importance and role of information through the building of an information culture.

In respect to staffing utilized to carry out the field exercise covering 720 sample households for *Aviso Prévio*, the following personnel are used:
MINAG – 6 covering 3 zones (south – 3 provinces, central – 4 provinces, north 3 - provinces)
Provincial – 2 per province [Head of agricultural production (SPA) and a supervisor]
District – 2 per district (30 districts covered)

A survey team consists of 2 district staff plus 1 provincial supervisor. The total number of staff deployed to carry out the field work is 86 (this number would increase upon acceptance of the "Development Program of the Early Warning System" – September, 2006) including MINAG (6), Provincial (20), District (60). The major function of the provincial staff is to check measurements. Data entry and processing are done centrally at MINAG.

The major constraint identified by Early Warning is the availability of funds. Funds need to be made available before the start of the crop season in Sep./Oct. The funding situation is further complicated by the fact that the cropping calendar is different from the fiscal calendar. All funds that are not utilized by the end of the calendar (fiscal) year are returned to government. Since there is no carryover, Early Warning waits for funds before undertaking field work. Funds for the 2006/07 agricultural crop were obtained in April. The end result was that training was not undertaken, field work started late, and only one field visit will be

made instead of three. There is the feeling that "People providing funds do not have a perception of the crop calendar."

Aviso Prévio indicated that the end of FAO assistance in 2000 created a dependency on Government for funding. The issue of funding in respect to amount and availability occupied the greatest amount of time in meetings with both central and provincial personnel. The control of funds centrally or directly at the appropriate administrative levels is also a contentious issue. One major difficulty experienced with decentralized funds is that financial resources provided to the District are not specially earmarked for Early Warning. The end result is that a District can utilize their resources any way they desire.

In September 2006 Early Warning prepared a document on a program to improve the early warning system. Proposed within that document is an increase in the number of districts covered by a field survey including crop cutting, and a corresponding reduction of districts where only a qualitative questionnaire is administered. The estimated annual cost of the *Aviso Prévio* field operation is projected at $198,700.

Results from *Aviso Prévio* are produced in a timely manner. It is for this reason that they are used by the Ministry of Planning and Development (MPD) for the evaluation of the PES even when they are known to be preliminary. There are, however, a number of problems with the current *Aviso Prévio* system including the following:
- the Early Warning Department has not sustained the capacity/capability to undertake the survey since FAO support ended in 2000,
- data collection in many provinces is irregular because of resource constraints and lack of training,
- unlike in other countries e.g. in the SADC sub-region, the system was started without an oversight committee to monitor the development of the system and approve crop forecasts,
- the documentation of the system does not render it sufficiently transparent for users to have full confidence in the data from this system,
- with funds for the system decentralized down to provinces and with the system not being given as much importance by the Provincial Governors as it should, data coverage has started to suffer and also reports from districts are not arriving on time, and
- decentralization has created a situation whereby staffing is done through the District. Creating the District Economic Service has resulted in less emphasis being placed on agriculture. At the district level there is a lack of trained manpower and logistical support.

The three main challenges identified by *Aviso Prévio* are:

Inadequate institutional support structure and collaboration: The main focus was on financial support to perform early warning field enumeration. This was followed by collaboration, particularly at the District level where sometimes limited importance is placed on agricultural information.

Limited institutional capacity: The issue of capacity at the central and provincial level is on training and re-training. The problem at the District level is that there are not sufficient members of staff with an appropriate agricultural background that understand the importance of information.

Untimely and incomplete information flow from the district: This becomes an issue when there is insufficient supervisory staff at the provincial level due to resource constraints. Field work has been conducted without participation of a provincial supervisor.

Famine Early Warning Systems (FEWS) NET and SETSAN

Also under the National Directorate of Agricultural Services is the Technical Secretariat of Food Security and Nutrition (SETSAN) and the USAID-funded Famine Early Warning Systems (FEWS) NET which is linked to SETSAN and housed in the same building. The Department of Early Warning is responsible for providing a forecast of crop production, whereas SETSAN and FEWS.NET assess food security on a regular basis. FEWS relies heavily on satellite imagery and modeling using Normalized Difference Vegetation Index (NDVI – photosynthetic activity), Meteosat Rainfall Estimation (RFE – time series rainfall comparison) and Waters Requirements Satisfaction Index (WRSI). SETSAN leads the Vulnerability Assessment Group and provides livelihood assessments within the context of food security. The Deputy Minister of Agriculture is the President of SETSAN and Deputy Ministers from the other Ministries are board members. There is also a Technical Committee (working group). A new structure is being developed with a view towards increasing coordination. SETSAN is supported by the Government, international donors and NGOs. SETSAN also has a provincial base. It is inter-ministerial since food security and nutrition issues are multi-sectoral.

Last year SETSAN conducted a baseline survey of 6,000 households between August and December, 2006. The survey covered agricultural production for most major crops, except cassava and a number of demographic, food security, health and nutritional questions. Currently SETSAN is conducting a new survey of 4,000 households (May, 2007) due to an abnormal crop season. It is necessary to know how people live and cope with limited resources.

SETSAN also uses secondary information for their work. They use information provided by parent ministries in respect to key indicators. The main challenge is that the information available is not timely and it is very costly to get information below the provincial level. When information is not available, then SETSAN proceeds to obtain what is missing with the permission of the parent ministry.

(c)   Coordination and Synergy

For the CAP which was last conducted in 2000 the MINAG and INE worked together as equal partners. A strong link and good working relations between INE and MINAG is an important ingredient in the development of a fully integrated National Information System. The very fact that this consultancy is being undertaken with support from the Ministry of Planning and Development (MPD), INE and MINAG (Directorates of Agricultural Services and Economics) indicates that collaboration and cooperation exist for obtaining more accurate, timely, relevant and cost -effective agricultural statistics.

SETSAN has a close relation to the Department of Statistics (MINAG) and INE in respect to methodology issues. For instance, two questions were added to the TIA survey instrument by SETSAN; one question dealt with the length of harvest and the other focused on the quality of the crop. SETSAN uses TIA as a reference point, but the TIA results are too late to have significant impact on evaluating food security and nutrition. At the same time, SETSAN realizes that TIA is a strong data set. One of the 8 staff members of the Early Warning Department is seconded to FEWS.NET. This is viewed as a means of linking *Aviso Prévio*, SETSAN and FEWS.NET. This not withstanding and even though SETSAN and *Aviso*

Prévio are in the same Directorate, there is limited technical collaboration. The two departments are also located in two different compounds. SETSAN views the process of obtaining Early Warning information as non-transparent. At the initial meeting with *Aviso Prévio*, the question was raised about the use of FEWS.NET bulletins by *Aviso Prévio*. The response received was - We are Government and we produce data for FEWS.NET not the other way around. There is, however, agreement that SETSAN and *Aviso Prévio* need to work more closely together.

Having different units within the Ministry to undertake different agricultural statistics activities is not the most efficient way to utilize available resources for statistical information. First of all, there is overlap in the information collected. Secondly, available resources including manpower and financial resources are duplicated and spread thin across Units. Thirdly capacity building and sustainability issues become elusive when the function for statistical information is parceled the way it is. Fourthly, there is no inter-institutional/agency oversight committee to vet the estimates produced by the *Aviso Prévio* as recommended by FAO in 1990 when it helped to create the early warning system. Fifthly, the exercise of statutory oversight and technical backstopping by INE becomes difficult when data collection activities are undertaken by different Units in MINAG.

(d)   Main Systems for Collecting Agricultural Data

The traditional sources of agricultural data are the administrative records, census of agriculture and livestock and agricultural surveys. However, increasingly, the Population and Housing Census is becoming an important source of basic data on agriculture as can be seen below:

Traditional Sources of Agricultural Data

Administrative Records

As part of their regular work, extension staffs compile a lot of agricultural data which they use to file monthly, quarterly, half yearly and annual reports to district authorities on such things as land utilization, rainfall conditions, crop plantings and production of food and cash crops, livestock and poultry data. The reports are collated by the Provincial Agricultural Officers and the reports from provinces are collated by the Ministry of Agriculture to produce national administrative data on agriculture. One good example of this is the *arrolament system* which the Directorate of Veterinary Services has over the years used to maintain a frame of livestock producers with a cattle headcount that is updated periodically. The data from the *arrolamento* are used by the Directorate of Veterinary Services in the districts to collect livestock data which the district uses for programming and operations e.g. disease control.

Apart from being a very rich source of agricultural data, the administrative data sources are cheaper and easier to sustain. However, administrative data sources generally have a number of problems. Much of the data are collected and compiled primarily for internal use, and usually without using standard statistical procedures or personnel who have had training in statistical methods. It is believed that a lot of these data are guess estimates or a reflection of set targets rather than actual levels of indicators. Some of them are believed to be of questionable quality. For instance, there is a concern that the *arrolamento* method is unable to give accurate livestock numbers because cattle dips were privatized and are not used by all cattle keepers. In the case of reporting on crops, operational constraints make it difficult for extension staff to go around their areas of jurisdiction to collect data. In addition, a lot of data from this source remain in raw form and are not turned into usable information for management.

Census of Agriculture and Livestock (Censo Agro-Pecuário - CAP)

The Census of Agriculture and Livestock (CAP) is the main source of **basic** or **stock data.** These data relate to *indicators, which change only slowly over time*. These indicators show the state of the organization and structure of the agricultural economy as delimited by the scope of a CAP programme, which is usually carried out every 10 years. The CAP collects comprehensive data from both small and large-scale holdings on the following: household characteristics, holding characteristics, agricultural inputs, crops, fruit trees, livestock, agricultural practices, marketing, storage, membership to associations and agricultural credit. The indicators include land utilization, agricultural practices (e.g. animal traction, irrigation, etc.), agricultural implements and machinery, agricultural labour, storage facilities and extension services. In many developing countries including Mozambique, the CAP is undertaken on a sample basis.

The main advantage of the CAP is that it is based on a large sample, which improves the reliability of estimates obtained from it. The main disadvantages of the CAP are: the complexity of the operation and the high cost which make it difficult to carry it out more frequently; estimates are subject to sampling errors which arise because the data are collected from a sample rather than from all farming units; and census estimates are only provided at national and provincial levels.

As mentioned earlier, the last and most comprehensive CAP was carried out by INE in close collaboration with MINAG in 1999/2000. This collaboration took on many forms including the Directorate for Economics at MINAG seconding staff to work at INE. In particular, the Deputy Director for the census was from MINAG. Various institutions and subject-matter experts were involved in data analysis and report writing. In addition to a main census report, thematic reports were prepared on Agricultural Inputs, Production of Basic Crops, Livestock Production, Cash Crops and Fruit Tree Production, Marketing of Agricultural Production, Agro-Ecological Zones, Land Tenure and Use, Agriculture, Gender and Development, and Marketing of Agriculture Products. In addition to these reports, data were disseminated using CDs and the Internet. The next CAP is strategically planned for 2009/2010 after the Population and Housing Census.

Agricultural Surveys

Why agricultural surveys?

Agricultural surveys are the main source of **current agricultural data.** These data relate to *performance indicators* of the agricultural sector i.e. those data that change more rapidly than basic data. The main indicators include input supplies, planted area by crop, crop yield and production, livestock production, crop and livestock marketing and agricultural prices. These indicators delimit the scope of the **current agricultural surveys**. Data on these indicators need to be collected or updated annually or more frequently. Some of them are collected from **primary sources** (farmers) in annual crop surveys while others are collected from **secondary sources** (institutions/bodies which compile them) such as the Meteorological Service and crop marketing boards.

Agricultural surveys have a number of distinctive advantages over censuses. Surveys are less costly, lead to increased accuracy and provide data in a timelier manner. However, surveys have a number of limitations. They are unable to provide highly disaggregated data (e.g. data at district level). They are also subject to sampling errors (errors which arise because data are collected on a sample rather than a whole population). However, the magnitude of these errors can be controlled and measured when the surveys are based on samples that will have been randomly (scientifically) selected.

The main agricultural surveys undertaken in the country are the *Aviso Prévio* and the TIA, described previously.

Population and Housing Census

A Population and Housing Census (PHC) is the most comprehensive source of benchmark social, economic and demographic data required for national development. In particular, the census collects data on population size, nature and distribution (by age and sex, tribe, religion, etc.) in a country; size, nature and distribution of the labour force; literacy and illiteracy rates for the population in different age groups and correlated variables; and housing characteristics of households with regard to tenure, type and availability of housing facilities. A well-organized and executed PHC provides a complete list of all places and persons, villages and households, and Enumeration Areas (EAs) for the whole country. These lists have been a useful source of information for constructing sampling frames for inter-censal large-scale household surveys such as *Aviso Prévio* and TIA. A sampling frame is a pre-requisite for random (scientific) sampling.

The first PHC for Mozambique after independence was carried out in 1997. The second census is due in August 2007. The census will collect information on:
- number of agricultural households
- number of agricultural households engaging in aquaculture (fish farming)
- number of agricultural households with members involved in artisan fishing
- number of agricultural households with cashew trees
- number of agricultural households with coconut trees
- number of households with livestock and number of cows, goats, sheep, pigs, chickens and ducks

The following figure summarizes the main sources of agricultural data and their uses.

Figure 1: Sources and Uses of Agricultural Data
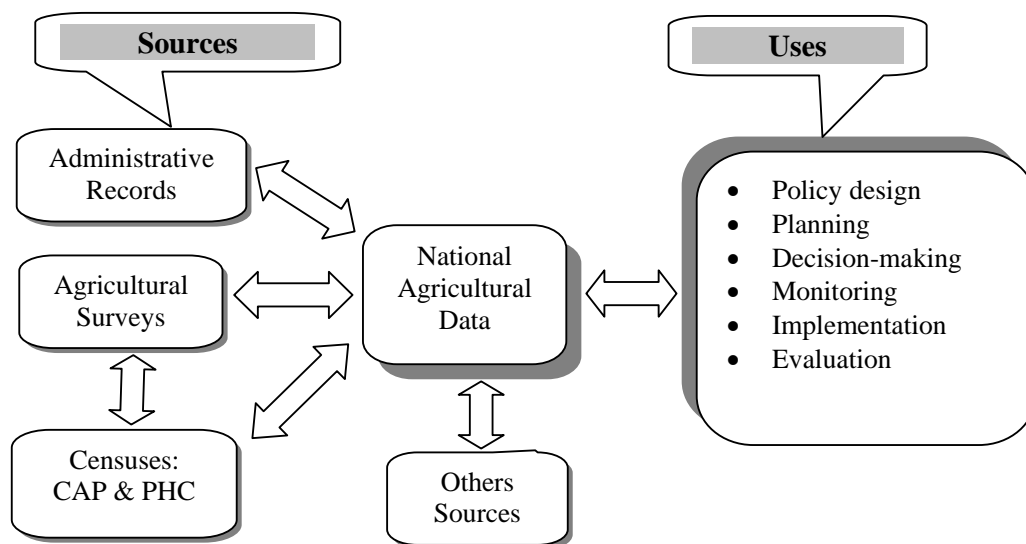
2.2.2 Methodologies for Data Collection

Sampling Methods

TIA

One of the advantages of the *Trabalho de Inquérito Agrícola* (TIA) is that it is based on a well-documented national probability sample of farm households. A stratified three-stage sample design is used for TIA. The sampling frame for TIA is based on the 1999/2000 Agricultural Census (*Censo Agro-Pecuário*, CAP), and in turn the sampling frame for the CAP was based on the 1997 Mozambique Census of Population and Housing. The CAP covered all the 128 rural districts of Mozambique, and included a sample of about 23,000 farm households.

For the CAP the primary sampling units (PSUs) were segments selected based on the frame of enumeration areas (EAs) defined for the 1997 Census. These segments were selected with probability proportional to size (PPS) within each district, where the measure of size was based on the number of farm households from the 1997 Census.

In the case of TIA the PSUs are the districts, and a sub-sample of the CAP segments were selected at the second stage within each sample district. These districts were stratified by province and agro-ecological zones. In some strata all the districts were included in the sample (that is, they were self-representing). Table 2.1 below shows the total number of agricultural households for each province in the TIA 2006 sample.

Table 2.1: 2006 TIA Sample Size and Distribution

	Agricultural households	
Province	Number	Percent
Niassa	342	5.47
Cabo Delgado	621	9.94
Nampula	845	13.52
Zambezia	824	13.19
Tete	686	10.98
Manica	544	8.71
Sofala	534	8.55
Inhambane	596	9.54
Gaza	815	13.04
Maputo	441	7.06
Total	**6248**	**100.00**

Methods for Data Collection

Different Units in the Ministry use different methods for data collection. This naturally affects data consistency on the same agricultural indicators across Units. For purposes of data consistency and comparability, the same methods e.g. sampling and weighting methods need to be used for *CAP*, *TIA* and *Aviso Prévio*. This is not happening and hence the lack of consistency in agricultural data produced by different Units.

Since the INE population projections by province become less accurate over time due to differential migration patterns, the 2007 Census of Population and Housing will be of vital importance for updating the sampling frames. As pointed out above, the census data will include information on the number of households with *machambas*, as well as the number of livestock by type of animal.

All the systems use both physical measurement and interviews to collect data. CAP and *Aviso Prévio* use the traditional compass and measuring tape method to measure holdings and cropped fields. This method which has been promoted by FAO in developing countries to increase the accuracy of area measurements involves:

- identifying the boundaries of the field to be measured;
- determining the shape of the field which is usually irregular and reducing the field to an *equivalent polygon* using **"give and take method"** (see figure 2 below);
- taking compass bearings of each side of the polygon with respect to the North;
- measuring the lengths of each side of the polygon using a tape measure;
- using a programmable calculator to calculate both the area of the field and *error of closure;* the latter is used as an indicator of how well the field will have been measured. So a low error of closure (usually less than 5%) does mean that the field will have been well measured.

TIA used Global Positioning System (GPS) equipment for measuring the farm size and area planted in crops, in addition to the measuring tape and compass method for measuring smaller plots. Research work done by the Uganda Bureau of Statistics and published in the African Statistical Journal shows that the time it takes to measure area using the compass and tape method can be cut by as much as 72% using the GPS[5].

Figure 2: Give and Take Method
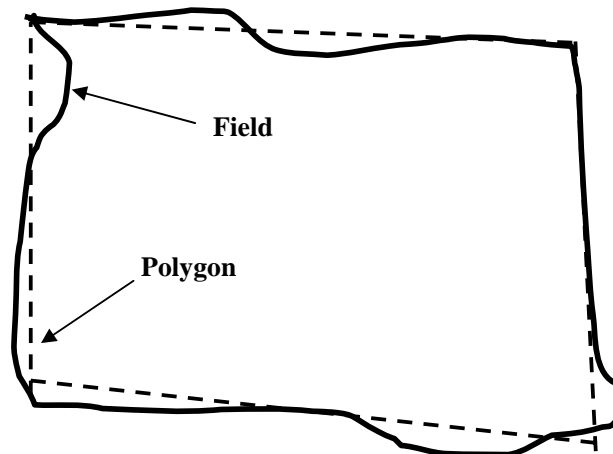
Both CAP (by default because it could not carry out phase II that involved yield measurement) and TIA collect production data by interviewing the farmer on how much they produce and sell. *Aviso Prévio* on the other hand estimates crop production through crop-cutting measurement to determine yield. Within each field of selected holdings, crop cuts are done on two randomly selected sub-plots (*parcelinhas*) of 7x7 meters. This is done at the time of harvest; so it is crucial

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[5]   *Experience with GPS Equipment in Measuring Crop Areas: The Case of Uganda by Dr. E.S.K.Muwanga-Zake and Mr. J.B. Magezi-Apuuli, African Statisical Journal, Vol. 1, 2005.*

that enumerators determine the time when the farmers will be harvesting their crop. Production is then calculated as a product of the estimated number of holdings, crop area and yield. The main source of yield forecast before harvest though is an estimate obtained from a model based on rainfall data, satellite imagery and other meteorological data, soil type, time of planting, etc. The model-based estimates of crop yield are compared to information from provincial and district officials; finally a consensus is reached on the crop yield figure to be used for the production estimates at the provincial level. A good summary of the *Aviso Prévio* methodology is provided in the FAO technical annex "Review and consolidation of methodological aspects relating to crop area, yield and production estimation procedures in Mozambique (12/2001 – 02/2002), by Jean-François Detry and Fernando Chilengue, February 2002, presented here in Annex IV.

There are some problems related to application of the *Aviso Prévio* methodology. First of all, given the lack of transparency, it is not clear how the final estimates of crop yields for *Aviso Prévio* are obtained. In calculating the average yield for each province from crop-cutting, it appears that *Aviso Prévio* is not using weights based on the probabilities of selection. Given that the sampling probabilities will vary by the size of a district, the unweighted estimates of crop yield would be biased. Secondly, FAO proposes use of different sub-plot sizes for different crops depending on crop density, so use of a standard sub-plot size for estimating yield for all crops covered is not "best practice". Also slightly different methods for measuring cassava yield have been proposed and could be used. Whatever methods are in use should be reviewed periodically for relevance and adequacy. The *Aviso Prévio* methodology has not been reviewed since FAO support ended and is in need of revision.

Use of the above physical methods for measuring area and yield require that enumerators are well trained, motivated and supervised. Hence, emphasis is placed on training and intensive supervision if the methods are to produce good results. After all, all methods are only as good as the people who use them.

Finally, the current methodologies are not focused on meeting the information needs from the lowest level. Meeting such needs is essential for attaining sustainable development. In this connection, concentrating on production and price information is central for the small-scale farmers where attention should be directed towards local market information systems that can be operated and sustained utilizing existing resources.

Documentation of Methodology

Best practice requires that whatever methods are used for data collection and processing are systematically documented. This enhances transparency of methods and also preserves institutional memory, which is very important given staff turnover in some Units in the Ministry, Provinces and Districts. Also survey reports should always be accompanied by *metadata*, describing how data were collected and handled. Statistics make better sense if they are explained. While *CAP* and *TIA* methodologies are well documented, that for *Aviso Prévio* is not complete or readily available.

For instance, it was reported that the methodology used by *Aviso Prévio* is not well understood at SETSAN since it is not clear how *Aviso Prévio* arrives at their forecasts. From the perspective of SETSAN, the issue of provincial estimates not meshing with national estimates needs to be addressed.

Application of Methodology

It is crucial that field work closely follows the methodology as documented. If for some reason there should be a departure from documented methodology, this should come out in survey reports. A visit to Gaza Province showed that the stated *Aviso Prévio* methodology is not strictly followed in the field.

Improvements have been made in management of TIA in respect to training, field data entry and funding management. However, the average interview time for TIA is too long, but this must be carefully weighed against the need for socio-economic data that can lead to better targeting of interventions. In a field visit to Gaza Province, the team found that because of limited transportation and other resources, the methodology documented in the *Aviso Prévio* manuals is not being implemented on a regular basis. In one of the sample districts of Gaza, last year the local staff was only able to complete crop cuttings in 5 of the 24 selected households. These 5 sample households were in two sample villages (out of the six selected) that were most accessible. This sample does not provide representative data on crop yields, so the province has to rely more on the models and indirect methods that may give results closer to expected targets.

2.2.3 Resources

Investment in statistical development is not commensurate with overall investment in the agricultural sector, and yet better statistics are needed for informing policy makers, setting priorities and investment in the sector. Without investment, it is not possible to build a sustainable capacity to collect and manage statistics at all levels. For instance, the *Aviso Prévio* has not improved their capacity/capabilities since FAO support ended. There is a great need to build sustainable capacity at all levels - capacity to collect and use information within districts, provinces and at the national level.

All MINAG Units that collect agricultural data seem to be reasonably well manned by various professionals. What is required, therefore, is to re-train them on statistics and statistical operations. While some of the professionals e.g. agronomists and economists have been exposed to statistics through some short-term courses or just by doing statistical work, there is a need to hire professional statisticians. Trained professional statisticians are required to design data collection, processing and disbursing systems, invoke and apply the UN Fundamental Principles of Official Statistics which give a set of fundamental values and principles that data producers should have in order for the public to have trust in official statistics they produce, and to ensure that professional, technical and ethical standards are applied in data collection and management. Much of this work has been done with technical assistance. This is the time to plan to hire trained statisticians because the first batch of students doing a degree course in statistics at the University is about to graduate.

At provincial and district levels, there is need for more training and supervision of field work. Turn-over of personnel is too high, so there is a need for continuous training so that staff can get up to speed. Training, re-training and retaining personnel should be the primary focus. Annex V contains a Proposed Training Course in Agricultural Statistics. There needs to be a commitment of at least 5 years whereby capacity is built. There is also a need for more extension staff to cover an entire district. The last major re-organization (January, 2007) at the district level whereby the district structure is different from the province (all functions under Economic Services) is having a negative impact (some confusion). It was recommended by the province that only permanent personnel that have long-term commitments be deployed on the collection of data. One other problem at provincial and district levels is inadequate transport to cover large areas. The vehicles currently in use are old, insufficient in number and not in good condition. There should be a better allocation of

transportation resources based on the age of the vehicle and the need to move from the center to the province to the district.

The allocation of funds and amount available is perceived to be the foremost problem at all levels. There are shortages of resources and budgets for the collection and management of statistical information especially in provinces and districts. In some cases, the funds are not available in time and yet agricultural data have to be collected at certain times during the agricultural season. Decentralized funding to provinces and districts has been responsible for delays in undertaking data collection activities or partial data collection or not collecting data at all in some places. Part of the problem is insufficient sensitization of provincial leadership about the role and importance of statistical data and information in managing public affairs and society in general.

2.2.4 Data Quality

It is crucial that agricultural data are of good quality to enhance their usability – data quality refers to "*fit for use*". There are different dimensions of quality. The first dimension is relevance. Data currently collected by different Units in the Ministry are relevant to the development of the sector. The second dimension is consistency between sources. There are large discrepancies between different sets of data on the same indicators. For instance, estimates of cereal production from *Aviso Prévio* are consistently higher at national level than the estimates from TIA, sometimes much higher e.g. by as much as 67% for 2005 as can be seen in table 2.2 below. The 1996 TIA was based on a different sampling frame prior to the 1997 Mozambique Census, so the results are not consistent in this series; the 1996 TIA estimates are currently being revised based on adjusted weights.

Table 2.2: Trends in Cereal Production Estimates from *Aviso Prévio* and TIA from 1996 to 2006 (thousand tons)

System	1996	2002	2003	2005	2006
Aviso Prévio	1,377	1,767	1,811	1,900	2,098
TIA	1,459	1,454	1,509	1,137	1,700
Difference	**+5.6%**	**-21.5%**	**-20.0%**	**-67.1%**	**-23.4%**

The discrepancies in estimates from *Aviso Prévio* and *TIA* can in part be attributed to different estimation procedures used by the two systems. The situation is worse at provincial level as can be seen in Annex VI. There are also discrepancies between estimates of livestock numbers for large animals from *CAP* and *TIA* on one hand and *arrolamento* on the other.

The third dimension of quality is accuracy which is a function of how samples are selected and how they are implemented in the field as well as how data are collected. Here issues of training of technicians who collect data, their supervision and the logistical support they get are crucial. *Aviso Prévio* uses a small sample which does not provide sufficient reliability below the provincial level. The Administrative Systems are sometimes used in some districts, but the methods are generally inconsistent. Annex VII is a discussion on Livestock Statistics and the importance of aligning the different sources of information.

One important dimension of data quality is data disaggregation especially down to districts. This is becoming more important given the devolution of the planning functions to districts. Apart from the Census of Population and Housing and possibly Administrative Systems such as *arrolamento* national systems of data collection based on samples are not able to provide data at district level. There is, therefore, a big need that is not being met.

Timeliness is of the essence if data are to be useful. One of the main issues about TIA is lack of timeliness. The survey should start the first week in August in the South and 2 weeks later in the Center and North. In 2002 the schedule was adhered to but for 2003, 2005 and 2006, field work did not start until September. Lack of timeliness in TIA data is the reason why it is not used for evaluation of the PES.

Finally, it is very useful if a data system produces data consistently over time so that trend analysis can be done to demonstrate improvement over time or lack of it. While the *Aviso Prévio* system has consistently produced data each year, the same cannot be said of TIA as the above table shows. In fact the TIA system started to produce data consistently from the time of CAP. Even then, in 2004, the survey was not carried out because it was an election year.

2.2.5   Comparison of 2005 Cereal Production Estimates from TIA and Aviso Prévio

In comparing the series of crop production estimates from TIA and *Aviso Prévio*, the cereal production estimates for the crop year 2004/2005 show the largest discrepancy. The Ministry of Planning and Development is concerned about the effect of this large discrepancy for the evaluation of the PES. Therefore the results for this year from both surveys were examined in more detail to determine the main sources of these discrepancies. This more comprehensive study using the 2005 crop production data should also illustrate some of the weaknesses in the current crop estimation systems that need to be improved.

The best way to determine the sources of discrepancy between the cereal production estimates from the two sources is to examine the different components of these estimates. An individual crop production estimate depends on the projected total number of farm households in each domain used for weighting purposes. Given the estimation procedures used for *Aviso Prévio*, the crop production results also depend on the estimate of total area planted in each crop as well as the yield or production per hectare. Therefore estimates of these different components from the *Aviso Prévio* and TIA were compared. Both surveys are stratified and implemented at the provincial level, so these components were compared by province. The results from this comparison are presented in Tables 1 to 5 of the Annex VI. Tables are shown for each of the four cereal crops (corn, rice, sorghum and millet), as well as the cereal aggregates. Some of the main issues illustrated by these tables are discussed here. The yield per hectare for each crop presented in the tables is based on the ratio of the total production to the area planted in the crop. This is different than the yields presented in the original *Aviso Prévio* tables, in which the yields are based on the crop area harvested. The yield was recalculated based on the total crop area planted for comparability purposes, since the yields from the TIA data are calculated in this way.

The production of estimates from both *Aviso Prévio* and TIA are highly dependent on the projected total number of farm households in the frame for the particular reference period. These surveys have very distinct methods of estimating the total number of farm households, resulting in considerable differences, as shown in Table 5 of Annex VI. For the 2004/05 crop year, the estimated total number of farm households used by *Aviso Prévio* (3,574,499), was 7.3 percent higher than the corresponding TIA estimate (3,332,803). This difference in the estimated size of the target population will directly result in a corresponding difference in the crop production results. The differences vary considerably by province; in the case of Sofala the total number of farm households from *Aviso Prévio* is 27.6 percent higher than the corresponding estimate for TIA, while in Manica the *Aviso Prévio* figure is lower by 9.2 percent.

The differences in the estimated number of farm households result from the different estimation methodologies used by the two surveys, even though they both use population projections from the *Instituto Nacional de Estatística* (INE). In the case of *Aviso Prévio*, the 1997 Mozambique Census data are used to determine the percent of the economically active population working in

agriculture in each province. The estimated total population in each province for December 31 of the year prior to the first harvest is based on the INE projections, and the total number of households is calculated by dividing the population by the average household size for the province from the 1997 Census. The data for Maputo City is combined with those for Maputo Province. At the national level the average number of persons per household from the 1997 Census was 3.97, which is significantly lower than the estimate from most of the household surveys, including the 2002 *Inquérito aos Agregados Familiares* (IAF) and the TIA. The projected total number of households is then multiplied by the percentage of economically active population working in agriculture from the 1997 Census to estimate the total number of farm households.

In the case of TIA, the original sampling frame from the CAP was based on the total number of farm households from the 1997 Mozambique Census data on whether the household had an agricultural operation (*machamba*). However, the current weights use the estimated total population in the province for August of the harvest year from the INE projections. The populations for the four major cities (Maputo/Matola, Beira and Nampula) are excluded from these population projections. Then the total number of farm households for each province is estimated by dividing the projected total population by the average household size from the survey data, which is consistently close to 5 persons per household, that is, one person higher than the 1997 Census average household size used by the *Aviso Prévio*. The TIA estimate is based on the assumption that all the rural households are involved in farming. Given that unpublished tables from the 1997 Census data indicate that over 95 percent of the rural households in most provinces have *machambas*, this may be a source of a slight upward bias in the estimate of the number of farm households in some provinces. The evaluation team recommends that this potential bias be studied further. Following the listing of households in each sample segment for TIA, all of the households are included in the sampling frame, and very few sample households are found with no agricultural activities.

In the opinion of the evaluation team, the method of estimating the total number of farm households in TIA is probably less subject to bias, since it excludes the large cities and is based on a more current estimate of household size. The method used by *Aviso Prévio* depends too much on the labor force information from the 1997 Census, including occupation and industry, and applies a population-based proportion (economically active working in agriculture) to the estimated number of households. Bias can result from a differential average number of economically-active persons per household in the urban and rural areas as well as misclassification in identifying farmers from the data on industrial classification. The estimated number of households for *Aviso Prévio* based on the average household size from the 1997 Census probably suffers from an upward bias, since all the national household surveys indicate a significantly higher number of persons per household.

Given that the INE population projections by province become less accurate over time due to differential migration patterns, the 2007 Mozambique Census of Population and Housing will be of vital importance for updating the sampling frames. The census data will include information on the number of households with *machambas*, as well as the number of livestock by type of animal.

The next component of total crop production that was compared is the total area planted in each crop. It is interesting to note in Table 1 of Annex VI that the estimate of total area planted in corn from TIA is 20 percent higher than the corresponding estimate from *Aviso Prévio*. After examining the methodology from the two surveys, the estimate of total crop area from TIA is considered to be more accurate, given the much larger sample size for TIA and the new listing of households conducted by TIA in sample segments for each survey. During the listing they identify medium and large size farms to be included in the sample with certainty at the last

sampling stage. The medium and large size farms have a different weight in the TIA data than the small farms in the same sample segment. On the other hand, the *Aviso Prévio* relies on a list of households from the village head; this list may be outdated, and it does not have any information on farm size. As a result, the average farm size is smaller in *Aviso Prévio* than in TIA. There is also a possibility of bias if the *Aviso Prévio* enumerators avoid larger farms because of the corresponding additional workload for area measurement.

The third component that affects the total crop production is the average yield per hectare. This is the most difficult component to evaluate, since the actual procedures implemented for *Aviso Prévio* are not transparent and therefore subject to unknown biases, and the TIA data collection methodology depends more on respondent recall. However, we can begin by examining the strengths of each source. In case of the *Aviso Prévio* crop-cutting is used for estimating yields, which is generally more reliable than recall, although it also tends to have an upward bias in some countries due to systematic biases in implementing the procedures. *Aviso Prévio* currently has a problem of resource constraints at the provincial and district levels, which can interfere with the effective implementation of the methods. The current methodology also involves the estimation of yields using a model based on rainfall data from satellite imagery and other meteorological data, soil type, time of planting, etc. The model-based estimates of crop yield are compared to those based on crop-cutting, and information from provincial and district officials; finally a consensus is reached on the crop yield figure to be used for the production estimates at the provincial level. However, given the lack of transparency, it is not clear how the final estimates of crop yields for *Aviso Prévio* are obtained. In calculating the average yield for each province from crop-cutting, it appears that *Aviso Prévio* is not using weights based on the probabilities of selection. Given that the sampling probabilities will vary by the size of a district, the unweighted estimates of crop yield would be biased.

In the case of TIA, the main strength is that it is based on a well-documented probability sample and a much larger sample size, resulting in a higher level of precision for crop production estimates. The TIA methodology of estimating the total number of farm households for the weights is considered more accurate than the corresponding procedures used by the *Aviso Prévio*. The estimates of area planted in each crop from TIA should also be more accurate, given the larger sample and the listing procedures, which identify the medium and large-size farms to be included in the sample with certainty at the second stage.

It is strongly recommended to integrate the two sets of information systems in order to take advantage of the strengths of each system for improving the efficiency of the agricultural statistics program and provide more accurate results at critical points in the timeline for the main data users. This can begin with an integration of the sample of farm households used for both surveys, as described elsewhere in this report. This integration of the surveys should also include a harmonization of the concepts and definitions, procedures for data collection, calendar of activities, data processing and data validation.

2.3   Data Dissemination and Use

The value of data lies in their being used. For this to happen, the data should be disseminated and understood. The CAP data were disseminated at a major stakeholders' workshop and through reports, CDs and the web site. TIA results are disseminated using the CD and the web site but no reports are published. Use of CDs as the main dissemination channel presupposes that most key data users have a computer and can manipulate it, which of course, is not the case. The *Aviso Prévio* produces Early Warning Reports.

Apart from the agricultural price information, which is published in newspapers and on radio, a lot of agricultural data are not widely disseminated for use.

Data from *Aviso Prévio* are used for early warning, but also in the absence of other timely data, they are used by the MPD in for the evaluation of the PES and for the Food Balance Sheet by the MIC. Data from CAP and TIA have been used extensively by the Ministry of Agriculture to analyze the agricultural economy, set priorities for research and agricultural investment. The Ministry of Agriculture is in the process of designing a Strategic Plan based on the said identified priorities. Market information is used extensively by the private sector especially traders and farmers. Researchers and policy analysts as well as donors and NGOs have found a lot of agricultural data useful in their work to plan support to the country and for reporting purposes. The data are more useful for planning as time series data have become available.

3. Main Conclusions and Key Recommendations

Based on the findings of the study, the following conclusions and recommendations are made:

3.1 Main Conclusions

- The demand for statistical data and information about the agricultural sector has increased dramatically over the past few years because of the need for clear and unambiguous systematic measurement and reporting on achievement of the impact of development policies and programmes such as the Action Plan for the Reduction of Absolute Poverty (PARPA I-II).
- The main sources of agricultural information are concentrated within the Ministry of Agriculture (MINAG) – in the Directorate of Economics (DE), which undertakes the annual agricultural survey (TIA) and the Agricultural Market Information System (SIMA), and in the National Directorate of Agricultural Services (DNSA) which undertakes the *Aviso Prévio*. Also under DNSA are the Technical Secretariat of Food Security and Nutrition (SETSAN) and the Famine Early Warning Systems (FEWS) NET.
- The Directorate of Economics (DE) has the formal mandate to coordinate all the statistical activities within the Ministry of Agriculture and the subordinate institutions, but at this stage this function is only partially accomplished.
- There is currently an overlap in the functions of the DE and the DNSA concerning data collection and statistical information, based on the official mandate for these two directorates, presented in Annex VIII.
- Neither of these systems provides agricultural data at district level. There is, therefore, a need for an *Administrative System (AS)* for collection and use of agricultural data in districts in view of decentralization. The *arrolamento* used by the Directorate of Veterinary Services in some districts is such a system that collects livestock data which the district and province uses for programming and operations e.g. vaccination and disease control.
- Having different units within the Ministry to undertake different agricultural statistics activities is not the most efficient way to utilize available resources for statistical information. Also, the exercise of statutory oversight and technical backstopping by INE becomes difficult when data collection activities are undertaken by different Units in MINAG.
- Different Units in the Ministry use different methods for data collection. This naturally affects data consistency on the same agricultural indicators across Units.
- Methodologies in use should be systematically documented to enhance transparency of methods and also to preserve institutional memory. While *TIA* methodology is well documented, that for *Aviso Prévio* is not complete or readily available. They also need to be reviewed periodically for relevance and adequacy. And survey reports should always be accompanied by *metadata*, describing how data were collected and handled.
- It is crucial that field work closely follows the methodology as documented. A visit to Gaza Province showed that the stated *Aviso Prévio* methodology is not strictly followed in the field.
- Improvements have been made in the management of TIA in respect to training, field data entry and funding oversight. However, the average interview time for TIA is too long, but this must be carefully weighed against the need for socio-economic data that can lead to better targeting of interventions.
- Investment in statistical development is not commensurate with overall investment in the agricultural sector, and yet better statistics are needed for informing policy makers, setting priorities and investment in the sector.

- There is no professionally trained statistician employed by the Department of Statistics in the Ministry of Agriculture who is delegated authority from INE to collect and manage official agricultural statistics.
- The allocation of funds and amount available is perceived to be the foremost problem at all levels. In some cases, the funds are not available in time and yet agricultural data have to be collected at certain times during the agricultural season.
- Decentralized funding to provinces and districts has been responsible for delays in undertaking data collection activities or partial data collection or not collecting data at all in some places.
- There are large discrepancies between estimates of cereal production from *Aviso Prévio* and TIA, with the former being consistently higher at national level. There are also discrepancies between estimates of livestock numbers for large animals from *CAP* and *TIA* on one hand and *arrolamento* on the other.
- Unlike *Aviso Prévio* data, TIA data lacks timeliness and this explains why TIA data are not used for evaluation of the PES.
- Data from the *Aviso Prévio* are disseminated through Early Warning Reports. While CAP data were disseminated at a major stakeholders' workshop and through reports, CDs and the web site, TIA results are disseminated using the CD, the web site and a workshop, but no reports are published. Use of CDs as the main dissemination channel presupposes that most key data users have a computer and can manipulate it, which of course, is not the case.
- Apart from the agricultural price information which is published in newspapers and broadcast on radio, a lot of agricultural data are not widely disseminated for use.
- Data from *Aviso Prévio* is used for early warning but also by default, for the evaluation of the PES. Data from CAP and TIA have been used extensively by the Ministry of Agriculture to analyze the agricultural economy, set priorities for research and agricultural investment.
- Given the relative importance that large farms can have in agricultural production for particular crops and livestock, both TIA and *Aviso Prévio* have a special frame for large farms. In the case of the *Aviso Prévio*, these farms are referred to as the agricultural enterprise sector or commercial farms; although most of these farms are large, the criteria for this frame are less clear, based more on the use of modern farming practices. Previously the agricultural enterprise sector included state farms, but the number of such farms has been decreasing over the years. The crop area and yield per hectare are estimated separately for the agricultural enterprise farms in *Aviso Prévio*, using mostly modeling techniques. For the TIA sampling frame, each district office is responsible for compiling a list of all the large farms in the district defined in terms of a minimum farm size or number of livestock. These large farms are supposed to be included in the TIA sample with certainty each year. In the case of TIA this frame is also important for the livestock estimates. However, it has been found that the lists of large farms are not complete and include some farms that no longer exist. In sample segments additional large farms are found that are not in the list frame, and are included with certainty at the second sampling stage with the weight of the medium-size farms; this reduces the sampling efficiency.
- The accuracy of the results from each survey depend both on the sampling errors given that the data are from a sample of the population, and biases, which are mostly due to nonsampling errors. In the case of the CAP, tables of sampling errors and confidence intervals for crop production estimates were presented in the report "*Análisis do Grau de Precisão para os Resultados do Censo Agro-Pecuário 1999-2000 de Moçambique, e Revisão dos Planos de Amostragem para o Trabalho de Inquérito Agrícola 2002*" (Megill, March 2002). It was found that the level of precision for CAP estimates was good at the provincial level for major crops, but the confidence intervals were wide for some minor crops. Most of the CAP results at the district level were found to be less reliable. Some sampling errors were tabulated for TIA 2002 and 2003, but not for more recent surveys. In

order to illustrate the level of precision for TIA 2005 results at the provincial level, Annex IX presents a table with the standard errors, coefficients of variation and confidence intervals for corn production estimates. The level of precision for the crop production estimates at the provincial level is reasonable for predominant crops such as corn; however, the provincial results are less reliable for some of the minor crops. Apparently no sampling errors are tabulated for the estimates from *Aviso Prévio*.

- There is currently a need for additional agricultural information with a gender perspective. There is also a lack of information on cost of production for different crops, which is needed for promoting agri-business and the transition from subsistence to more market-oriented farming.

3.2 Key Recommendations

The following recommendations if implemented, can very much improve the quantity, type and quality of agricultural statistics and their use especially in policy and decision-making in the country.

3.2.1 Institutional Re-alignment

1. The following recommendations are made in order to place the major statistical activities under the Directorate of Economics. This has a number of advantages including making it easier for INE to exercise its mandated oversight over the statistical work of the Ministry. These recommendations are sequenced in relation to the amount of political will required to bring about change:
   - The Department of Statistics fulfills its mandate from INE by approving all statistical activities and is the sole official source of information from MINAG;
   - A **Department of National Agricultural Information Systems (DNAIS)**, formerly know as the Department of Statistics is created under the Directorate of Economics;
   - A **National Agricultural Information Committee (NAIC)** chaired by the MINAG Permanent Secretary is formed to oversee the development of the national agricultural information system, approve crop forecast estimates and advise government on food status in the country;
   - A **Technical Committee for NAIS (TCNAIS)** is created that overseas all technical and operational matters;
   - The DNAIS should provide the secretariat for the Technical Committee as well as the NAIC;
   - Both TIA and *Aviso Prévio* are placed within NAIS and merged to form an Agricultural Survey Unit in order to achieve synergy, efficiency, cost-effectiveness and credibility in agricultural statistics; and
   - SIMA remains as a separate unit under NAIS.
2. As a Secretariat, SESTAN should not be involved in data collection from primary sources i.e. households. Rather, it should be collating data from secondary sources such as INE, Ministry of Health, etc. Where required data are not available, it should urge for their collection. FEWS NET should remain a unit under SESTAN
3. In the longer term, the integration should be extended to all departments that collect data in the Ministry of Agriculture by subsuming them under one directorate, a Directorate of Agricultural Information.

3.2.2 Methodologies

1. A more continuous survey methodology should be adopted throughout the year. This should begin by emphasizing use of the same sampling frame from INE with sub-sampling

from the bigger TIA sample for the *Aviso Prévio* where necessary. The same population projection methodologies, weighting systems, etc. should be used for the different components of the system. The nature of the outputs (such as release of critical results) at each phase should be clearly explained to the data users. It is critical that post-harvest results are available in time for the evaluation of the PES. An integrated calendar of survey activities for the Aviso Prévio and TIA should be based on the agricultural calendar and the timing of key survey results needed by data users. An example of such a calendar is presented in Annex X.

2. Methodologies should follow international best practice, be properly documented and followed in the field as much as possible. Also the methodologies used should be explained in survey reports as part of the metadata to enhance transparency.

3. The methodology for *Aviso Prévio* should be reviewed with regard to the size of the sample used, how crop yield is finally determined, how cassava production is estimated and how it is funded.

4. The strong leadership of INE should be used in the development of the vision to create an information culture that extends to individuals by reaching the lowest administrative levels through a community-based interactive information system. One of the four strategies in the next INE's medium-term plan is to develop district/municipal level data.

5. For livestock data, the coming Population and Housing Census can provide a good count of livestock that should be used as a base figure for livestock. TIA should continue to provide national and provincial data for small animals and for vaccination rates for large animals. The survey sample should be redesigned after the Population and Housing Census in such a way that areas with concentrations of large livestock are over-sampled for purposes of getting more reliable livestock data. For large animals, the *arrolamento* should be revived, perfected and used as a source of animal counts for local programmes.

6. In addition to abattoirs, information on animal slaughters should be collected from TIA. A special methodology should be developed for estimating meat production, which includes the slaughter conducted in informal establishments.

7. A special study should be undertaken to obtain more detailed information on cashew production and economy. Sometimes a special survey may need to be conducted for cashews in addition to TIA, given that the harvest season for cashews varies by region of the country. The cashew production is also concentrated is specific areas, which may require special sampling procedures. Such surveys could be conducted by the Department of Statistics in collaboration with the National Cashew Institute (INCAJU). Other sources such as administrative records for processing and export should also be taken in account, to complement the results from TIA.

8. Special surveys should be undertaken to estimate:
   - fruit production
   - vegetable production mainly in urban and peri-urban areas
   - cost of production (*the coverage of the survey should include fertilizer usage and costs, seed application rate and costs, pesticides application rates and costs, credit costs, transport costs, cost of hired labour, labour requirements and cost, farm implement ownership and costs, and gross margin calculations*)
   - in-land fish catch and characteristics of fishermen
   - the extent and growth of agroforestry, forestry plantations and natural forests, and to estimate fuel wood consumption in the country.
   - wildlife numbers and types.

9. In the case of particular crops that are processed or involve centralized marketing, sometimes reliable information on production figures or area planted may be available. Examples of such crops are cashews, sugar cane, rice and tobacco. In some cases a farmers association may be involved in marketing or maintaining records. When this type of information is available, it can be used together with the information from *Aviso Prévio* and TIA to improve the accuracy of agricultural statistics for these crops. For some crops

there may also be administrative information on the area of the crop planted, which can be used together with the survey estimates of average yield per hectare or tree to estimate the total crop production based on ratio estimation.

10. In order to align the *Aviso Prévio* and TIA methodology and rationalize the use of resources for the agricultural sampling frames, the assessment team recommends that a systematic approach be used for developing and maintaining a unified directory of large and commercial farms that can be used for all surveys. Sufficient resources should be allocated for updating this directory over time. Eventually it would be ideal for this directory to be maintained by INE as a component of the business register (*ficheiro de unidades estatísticas*, FUE).

11. It is important to take into consideration the need for sex-disaggregated data for a gender perspective in the results from the agricultural censuses and surveys. For example, in TIA it may be possible to collect some data in relation to the farms of individual household members instead of just the head of household. This will facilitate the analysis of the important role of women as agricultural operators.

12. In order for MINAG to promote the growth of agri-business and the transition from subsistence to more market-oriented farming, there is a need for information on the cost of production for different crops, including transportation and marketing. This type of information can be collected every 3 years with the more comprehensive TIA.

3.2.3 Resources

1. It is recommended that greater investment be made to develop capacity for statistical production and use. In particular, the Department of National Agricultural Information Systems should be manned by senior professional statistical staff trained in survey sampling and management. There should be training of staff and technicians involved in data collection and handling at all levels.

2. In order to make data collection and management more efficient, there should be an increase in operational resources, budgets and logistics at all levels. Creating a Directorate for Agricultural Information will increase bargaining power for resources. It is also important that funds are disbursed in time as agricultural data have to be collected at certain times during the agricultural season.

3. In order to provide the Department of Statistics with more qualified personnel, a plan for continuous training of the existing staff and recruitment of additional staff should be considered a priority, especially for methodology (sampling, survey design and management, and data analysis).

4. Experience with the TIA budget has shown that decentralization of the survey budget to provinces and districts does not work well. It is therefore recommended that the funds for undertaking all national agricultural information activities should be provided centrally.

3.2.4 Data Quality

1. It is recommended that the methodologies for data collection should be reviewed taking into account the experience so far gained in planning and management of surveys. As much as possible, the same methodologies should be used.

2. Every effort should be made to keep the TIA survey questionnaires short. This can best be done by undertaking a Heavy TIA every 3 years to collect data on variables which do not change much and a Light TIA in off years for variables which change frequently. Some of the indicators should be covered by INE in its socio-economic surveys. Others of a structural nature should be collected in the CAP.

3. More intensive training and supervision of field staff should be done to improve the quality of field data. Also the logistics required for managing field operations should be provided well

in advance of field work and made available seamlessly since the crop season is different from the fiscal year.

4. It is important to tabulate the sampling errors for the most important estimates from each survey, using software programs that take into account the stratification and clustering in the sample design, such as Stata or CENVAR, a component of the Integrated Microcomputer Processing System (IMPS). Tables of standard errors and confidence intervals similar to the one presented in Annex IX should be included in the survey reports.

3.2.5   Data Dissemination, Analysis and Use

1. It is recommended that statistical reports should be written for TIA results each time the survey is conducted. The reports should be comprehensive and in addition to data, should provide metadata. Electronic dissemination using the CD and the web site should continue to be used.

2. It is important to strengthen the capacity of the staff for data analysis in order to improve the utilization of the data for policy-making.

3. A user-friendly and accessible agricultural database should be designed. Serious data users (researchers, academicians and students at Universities) should be encouraged to access data from the database and use it for policy and other forms of data analysis.

4. To the extent possible and learning from dissemination of agricultural price information, extensive dissemination of all agricultural data should be made. In particular, results of surveys should be disseminated to farmers' groups to be passed on to individual farmers.

5. The timetable for conducting TIA should be revised so that results can be made available in good time for use in the evaluation of the PES. Data from *Aviso Prévio* which is provisional should not be used for evaluating the PES.

6. In the case of the Food Balance Sheet, the indicators based on the data from *Aviso Prévio* should later be finalized with the post-harvest crop production estimates from TIA.

7. It is very important for MINAG to have an active web site with updated information on all the most important agricultural and livestock indicators, as well as links to other major sources of agricultural information. The Department of Statistics can take a lead in this effort, but this should be in coordination with the Department of IT, and with support at the highest levels of MINAG.

3.2.6   Designing a strategic plan for the development of agricultural statistics

1.   The Reference regional Strategic Framework for Statistical Capacity Building in Africa (RRSF) which was adopted by the Conference of African Ministers of Finance and Planning in 2007 urges all countries in Africa to design a National Strategy for the Development of Statistics (NSDS). The NSDS aims to:

- Address data limitations which are constraining development progress,
- Provide a framework for prioritizing the use of limited resources,
- Integrating statistic as within policy processes,
- Providing a robust and coherent framework for all statistics and statistical capacity, and building programmes across the entire National Statistical System.

2.   The NSDS design process should involve the design of sector strategic plans for statistics, which then can be used as building blocks for the overall NSDS. In this connection, it is recommended that a strategic plan for the development of agricultural statistics be developed in the context of the overall statistical planning that INE is undertaking.

3.2.7   Implementation of Recommendations in Assessment Report

1. In order to ensure effective implementation of the key recommendations in this report, it is proposed that a working committee be established involving key staff from the current

agricultural information system including Aviso Prévio and TIA. This committee would be responsible for developing a working plan for all aspects of the system, including harmonization and integration of different components of the system.

2. The recommendations on institutional re-alignment will need attention at the highest levels of MINAG and INE.

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ANNEX I

Terms of Reference for the evaluation of current base of agricultural statistics in the Ministry of Agriculture (MINAG) and designing a methodological approach for the future

1. Introduction

As decreed by government under the delegation of responsibilities, the Ministry of Agriculture (MINAG), through the Directorate of Economics, is responsible for the production of official agricultural statistics that, in principle, should be used in the calculation of the national income accounts. The official statistics should also indicate the performance of the agricultural sector and its contribution to the economy in general and to the eradication of poverty in particular. These statistics should also be used as a basis for planning and monitoring the implementation of agricultural policy. For statistics to meet these objectives, the agricultural sector is challenged to produce timely, reliable, and credible statistics.

Background

The demand for high quality data and statistical information about the agricultural sector has increased dramatically over the past few years. This increase was brought about by the increasing need for timely statistical information that supports and serves as a basis for analyzing, monitoring and evaluating development policies for the agricultural sector, including food security. The impacts of these policy actions are measured through the indicators defined in PARPA, the strategy document for the reduction of poverty in Mozambique.

In addition, economic growth in general and the contribution of agriculture to the national economy and in particular to GDP should be estimated in a way that establishes policy measures and concrete goals that contribute to agricultural and rural development in general, and to the eradication of absolute poverty, in particular.

Another source of demand for agricultural statistics comes from agricultural and academic researchers, particularly students who are writing their undergraduate or graduate theses.

Agricultural statistics are also actively sought by nongovernmental organizations (NGOs) and by the private sector, especially by investors and institutions promoting private sector agricultural investment.

The current state of agricultural statistics is, however, characterized by a polarization. On one end, there is a database of statistical information obtained through sample surveys that uses a universally accepted methodology to produce statistics of vital importance to the sector and for overall national planning, but the information is not available in a timely fashion. These statistics are also not widely published and disseminated and thus, potential users of the data, internal or external to MINAG, have limited access to the data.

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On the other end, forecasts of crop production, estimated using a different methodology, are generated regularly and available in a timelier manner through the Early Warning System. These forecasts are used in the calculation of production statistics and the evaluation of the PES (Economic and Social Plan). The same figures are sent to the Ministry of Planning and Development for use in the PES despite being classified as "preliminary".

Users of agricultural statistics therefore turn to one or the other source of information to address the same issues, resulting in situations where different numbers are used to represent the same indicator for the agricultural sector. The problem becomes more glaring when the different sources show huge discrepancies in their estimates and trends.

2. General Objectives of the Study

- Provide a detailed description and in-depth analysis of the current state of the sub-system of agricultural statistics, identifying the principal sources of statistical information within and outside of MINAG.
- Provide an assessment of the quality of the statistics, identifying their strengths and weaknesses and based on this assessment, give recommendations on how to improve upon the current state.

3. Specific Objectives

Without excluding other relevant aspects, the study should be designed to do the following:

- Provide a review and evaluation of the different sources of data and statistical or administrative information about the agricultural sector within and outside MINAG.
- Analyze the reasons for the discrepancies in cereal production for the year 2005 between the two sources of information (*Trabalho de Inquérito Agrícola* and *Aviso Prévio*)
- Assist MINAG in identifying the key sources of information for the agricultural sector and its links to secondary sources
- Identify the principal needs for data and statistical information to be produced by the Department of Statistics and by other sources as well as when they should be made available
- Evaluate the existing capacities of the principal sources that generate statistics, clearly identifying the need to strengthen capacity in distinct aspects in the production of statistics taking into account the sustainability of the process, efficient use of resources, and the interaction and synergies that should be developed.
- Evaluate the actual state of the existing statistical databases of the agricultural sector and give recommendations on improvements to be made
- Evaluate the existing capacity in the area of data processing including time spent on this activity and in analysis of the data.

- Evaluate dissemination activities and the level of usage of statistical data, particularly for analyses that lead to useful information and recommendations in policy-formulation.
- Evaluate how the various activities related to agricultural statistics are financed.
- Make recommendations on all issues covered above, including further studies and changes that should be implemented to improve the quality of agricultural statistics and their use.

4. Methodology

Amongst others, the following methodologies are recommended:

- Interview main contributors to ensure that the necessary information on different aspects of the study is completed.
- Assess existing documents, including previous relevant consultancy reviews, projects plans, and progress reports.
- Consult users of statistical information.
- Present results in a seminar to be organized by MINAG.

5. Expected Results

This consultancy should produce a document, presented in a seminar to be organized by MINAG, containing:

- An analysis of the key sources of information for the agrarian sector's interconnectivity and organization.
- Appreciation of the quality of agrarian statistics currently being produced in the country with evidence of its reliability, credibility, and punctuality of dissemination.
- Evidence of the development of agrarian statistics in MINAG in terms of the aforementioned qualities.
- Principal recommendations, including the following:
  - Methodologies used must exercise proper procedures in internationally recognized statistics that take into consideration the integration into PES.
  - The estimated *inputs* that the TIA[1] and the *Aviso Prévio* need in order to improve.
  - Use of the TIA and *Aviso Prévio* data.
  - **Studies being undertaken** that will be implemented to improve the quality of agricultural statistics and their use.
  - **Principal interventions being taken** by the main contributors and partners of the sub-system of agrarian statistics.
  - **Actions being executed** to strengthen the capacities of the statistical activities and to eliminate the unnecessary duplication and conflicting data over similar variables.
  - Proposal by the *Plan of Action* that will serve as a reference point for the statistical activity of the agrarian sector as well as the base for the *Master Plan de Estatísticas Agrárias*.

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[1] Trabalho de Inquérito Agrícola (Annual agricultural survey)

The results of the study will be presented in a seminar to be organized by MINAG, MPD and INE.

6. Key qualifications:

The consultants should exhibit appropriate qualifications in agricultural statistics Ph.D. or a M.Sc. holders with long experience in the production of official statistics in African countries, which includes the methodological issues and statistical data analysis. Experience in sampling, data collection evaluation, master plan design, work with the Food Security Early Warning (Aviso Prévio), experience in agricultural census or agricultural surveys and data analysis are highly recommended.

The team should be made of four (4) consultants of which three (3) international consultants (in the fields of sampling and methodologies, data analysis and data utilization for policy formulation, planning and an expert in institutional organization of statistical agencies particularly in Africa). The national consultant should have a deep knowledge of statistics and should assist in the translation of the documents, help in whichever way possible to implement the study among other activities to be assigned by the team leader.

7. Duration of the consultancy: 21 working days
8. Starting date: April 2007
9. Location: Maputo, with few trips to Maputo and Gaza provinces, if necessary

ANNEX II

List of Officials Met

Name	Institution	Function
Maria José Zimmermann	FAO	FAO Representative in Mozambique and Swaziland
Margarida David e Silva	FAO	Assistant FAO Representative-Programme
Alejandro Acosta	FAO	Consultant
Eugenio Macamo	FAO	Programme Officer
Valeriano Levene	National Statistical Institute – INE	Vice President for Economic Affairs
Azarias Nhanzimo	National Statistical Institute – INE	Director - Department Sectoral Statistics
Saide Dade	National Statistical Institute – INE	Director - Department of National Accounts
Camilo Amade	National Statistical Institute – INE	Director
Júlio Mchola	Ministry of Ariculture (MINAG)	Permanent Secretary
Ventura Macamo	MINAG	Vet. Doctor/Minister Advisor
Boaventura Nuvunga	MINAG/Directorate of Agrarian Services	
Mário Ubisse	MINAG/Directorate of Agrarian Services	
Zulmira Munguambe	MINAG/Directorate of Agrarian Services	
Gil Nhantumbo	MINAG/Directorate of Agrarian Services	Technician
Tomás A. Sitoe	MINAG/Directorate of Agrarian Services	Technician
Fernando Songane	MINAG/Directorate of Economics	PROAGRI Project Co-ordinator
Domingos Diogo	MINAG/Directorate of Economics/DEST	Advisor
Ellen Payongayong	MINAG/Directorate of Economics, MSU	Advisor
Adriano Chamusso	MINAG/Directorate of Economics	Director
Lucia Luciano	MINAG/Directorate of Economics	Deputy Director
Marcelo Chauque	MINAG/Directorate of Economics	Head of Planning Department
Aurelio Mate	MINAG/Directorate of Economics	Head of Department of Statistics
Rafael Achicada	MINAG/Directorate of Economics	Technician
Abubacar Batista	MINAG/Directorate of Economics	Technician
Salvador A. L. Cardoso	MINAG/ Directorate of Economics	Technician
Anabela Mabote	MINAG/Directorate of Economics	Technician
Eulália Macamo	MINAG/Directorate of Economics	Technician
Arlindo Mazivila	MINAG/Directorate of Economics	Technician/Agronomist
Luis Osvaldo	MINAG/Directorate of Economics	Technician
Antonio Paulo	MINAG/Directorate of Economics	Technician
Maria Selemane	MINAG/Directorate of Economics	Technician
Felisberto Alage	DE/DEST	Techinician
Noé Alage	DE/DEST	Technician in SIG (GIS)
Monasse Jorge	DE/DEST	Technician
Florencia M. Cipriano	MINAG/Directorate of Veterinary Services	Director
Suzana Jamal	MINAG/Directorate of Veterinary Services	
Zacarias Massicane	MINAG/Directorate of Veterinary Services	Technician
Calisto Bias	Institute of Agricultural Research in Mozambique	Director General
Issac G. Mlay	Institute of Agricultural Research in Mozambique (IIAM) , MSU	Project Co-ordinator
Rafael Uaene	IIAM/ PURAME	
Filomena Paiopue	Institute of Cashew (INCAJU)	Director
Antonio Sive	Cotton Institute of Mozambique	Technician
Marcela Libombo	SETSAN - Technical Secretariat of Food Security & Nutrition	
Adriano Ubisse	Ministry of Planning and Development (MPD)	Deputy Director of Statistics
Channing Arndt	Purdue University/MPD	Professor, Economic Advisor

Alexander J.F. Schalke	Ministry of Industry and Trade	Agricultural Economist/Consultant in Market and Commercial Information
Emilio Tostato	Eduardo Mondlane University	Lecturer
Joana Madime	Gaza Province	Director
Julião C. Jordão	Gaza Province	Head of Dept. of Economics
Daniel Manuel Maduma	Provincial Agrarian Services/Gaza	Technician
Emília Sara Adelino Macie	Provincial Vet. Services/Gaza	
Angelo Soto	Gaza	
Antonio Jacinto da Graça	Gaza/DNSA/Aviso Prévio	Technician
Aderito Mavie	Directorate of Economic Activities, Chokwe District	Director
Paulo Jossefa Veloso	Directorate of Economic Activities, Chokwe District	Vet. Doctor/ Vet Services Delegate
Rafael Stefan Ubisse	Directorate of Economic Activities, Chokwe District	Statistics Planning Technician
Jorge Alexandre	Chokwe	Technician
Inacio Monjane	Chokwe/Agriculture Sector	Technician

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ANNEX III

Agricultural Data Sources

	Source	Type of data
1.	Population and Housing Census (RGPH)	1.1 Enumeration Areas (EAs) to be used as sampling frame for CAP and agricultural surveys 1.2 total population (*by geographic and other breakdown*) 1.3 number of agricultural households 1.4 number of agricultural households engaging in aquaculture (*fish farming*) 1.5 number of agricultural households with members involved in artisan fishing 1.6 number of agricultural households with cashew trees 1.7 number of agricultural households with coconut trees 1.8 number of households with livestock and number of livestock (*cows, goats, sheep, pigs, chicken and ducks*)
2.	Census of Agriculture and Livestock (CAP)	*Benchmark data on the organization and structure of the agricultural sector. There are eight census items considered essential for national and international purposes*: 2.1 Holding by type (*e.g. subsistence, commercial, etc*) 2.2 Characteristics of holder (*e.g. gender, education level, etc*) 2.3 Population and employment 2.4 Land use 2.5 Agricultural practice (*irrigation, use of fertilizers by type, animal traction, etc*) 2.6 Crop area, yield and production (*including tree crops*) 2.7 Livestock production by type 2.8 Machinery, equipment and storage
3.	Agricultural Surveys • Annual agricultural survey (**Light TIA**) • Agricultural survey (**Heavy TIA – every 3 years**)	*Current agricultural data for measuring performance of agricultural sector from year to year.* • Crop forecasts (planted area, inputs, yield, production) • Livestock production • Post-harvest data (*harvested area, yield and production, sale of staple food crops, cash crops*) • Items in Light TIA plus: • Access to services, credit • Remittances and pensions • Vegetables and other crops • Fruit trees • Cashew and coconut trees • Livestock (*detailed*) • Livestock by-products • Well-being, food security and household vulnerability

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4.	Other Sources	*Supplementary information*
		• Crop and agro-meteorological conditions (*Provincial Agricultural Offices, Meteorology Department, Satellite Images*)
		• Prices

ANNEX IV

Summary of Aviso Prévio Methodology[6]

Box: Current Sampling Methodology of the EWD/MADER

Sampling scheme: In each district selected for the survey, the villages are stratified into two size classes and 3 villages are selected at random from each. No agro-ecological stratification is applied. Then 4 farms are selected at random from each sample village. Therefore the total size of the sample is now:

- 10 provinces x 3 districts x 2 Strata x 3 villages x 4 farms = 720 holdings for the whole country and 24 farms per selected district.

Measurement of fields: All fields of selected holdings are measured using a measuring compass and tape. The sides and angles of the field are keyed into a programmable pocket calculator to obtain the area of the field and the closing error of the observations. Enumerators have been trained to work as precisely as possible. Therefore any small irregularity of the shape of the field is taken into account and the number of sides recognised is often 10 or more, as can be seen from the sketches and measurements recorded.

Crop cuts for yield estimates: Crop cuts are done on two randomly selected sample plots of 7x7 meters (*parcelinhas*) within each field of selected holdings. The crops covered are maize, sorghum, millet, rice, cassava, cowpeas and beans. The number of ears or cobs (espigas, macarocas) or roots are counted and weighed. In case of mixed crops (*consociação*) the crop cuts are done separately for each crop found in the sample plots.

In principle, this method will ensure an unbiased random sample of crop yield observations. In practice, there is the great problem for enumerators to arrive at the right time of harvest in each of the sample fields. It is unavoidable that in a number of cases the crops are already harvested or one of the crops of the mixture may have been taken out, another still remaining in the field. Enumerators may be tempted to make up for the loss of data by replacing the field with one nearby. This will then tend to be a good field, causing further over-estimation of the yield figures.

Mixed crops and plant density counts: According to the methodology of the EWD sample survey, every single crop that may be found in associations, is taken into account. A proportion of the area of the field is allocated to each crop, according to its relative density, as follows:

The crop coefficients CA are calculated every year again, based on the actual densities that year in each district. On a sample of 24 farms the number of observations for each crop is small, especially for the minor crops of the district. Because of the small sample the coefficients will also vary wildly from year to year. When a crop is not found in pure stand at all on any of the sample farms, the area of one plant is measured (see Manual 2, p.19). Please note that this is very difficult in practice, unless crops are grown in rows with regular spacing.

The number of plants of each crop within the squares is counted. In case of mixed crops this information is used to divide the area of the field among the crops grown. In each district the average density of crops in pure stands (*culturas em extreme*) is calculated from all plant counts in sample plots, that were done during the current year. In case of mixed crops the proportion of the area of the field to be allocated to each crop in the mixture is calculated based on their relative plant density, as compared to a pure stand, within the squares. An adjustment is applied to make sure that the sum of the areas of each crop equals the physical area of the field.

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[6] *Review and consolidation of methodological aspects relating to crop area, yield and production estimation procedures in Mozambique, FAO Mission report by* **Jean-François Detry and Fernando Chilengue, February 2002**

ANNEX V

Proposed Training Course in Agricultural Statistics

1.   Objective of Training Programme

The review of the agricultural data system in Mozambique in April/May 2007 showed that the demand for agricultural data is high and is increasing. It, however, identified data quality as an issue that needs attention in order to enhance the usability of agricultural data. It was found that one of the causes of lack of data quality had to do with inadequate training for staff that design data collection systems, collect data and manage data once collected.

In order to enhance agricultural data quality, it is proposed that training in agricultural statistics be scaled up beginning with training of trainers. The proposed short training course aims to build capacity and in particular, to upgrade the workplace skills and expertise for technicians in the data production cycle including data processing, analysis, reporting, dissemination and use.

2.   Duration

It is proposed that the training should last for 2-3 weeks.

3.   Participants

Up to 50 participants from the Ministry of Agriculture, INE and other institutions involved in production and management of agricultural data should be trained. These will constitute a core team of possible trainers.

4.   Trainers

Two consultants should be hired to facilitate this training course. A data users who will expose the participants to issues of evidence-based planning, policy and decision-making – covering such things as development agenda including PARPAII, MDGs, and others; development indicators; monitoring and evaluation; reporting; etc.

5.   Coverage

Subjects to be covered during training will include:

Demand for data

- Concept of managing for results
- Main national development agenda – PROAGRI, PARPAII, MDGs.
- Statistical requirements national development agenda (indicators, reporting framework, etc)

Data supply

I.   Introduction

- Role of agricultural data in management of agricultural sector

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- Type of agricultural data required
- Main sources of agricultural data

II. Basic concepts used in agricultural surveys
- Sample surveys versus census
- Subjective versus probability sampling
- Sampling frame
- Basic principles of sample survey design
- Estimators and their properties
- Error in censuses and sample surveys

III. Basic sampling procedures
- Introduction
- Simple random sampling
- Systematic sampling
- Stratified sampling
- PPS sampling
- Cluster sampling
- Multi-stage sampling

IV. Planning and design of agricultural surveys
- Basic stages involved in agricultural surveys
- Important considerations in planning agricultural surveys
- Design of survey instruments

V. Implementation of agricultural surveys
- Introduction
- Area measurement methods
- Measurement of crop yields
- Field organization

VI. Data management
- Data entry
- Data processing
- Data analysis
- Reporting
- Database versus dataset
- Report writing
- Dissemination

ANNEX VI

Tables on 2005 Estimates of Total Cereal Production from TIA and *Aviso Prévio*

Table 1. Comparison of Household-Based Corn Production and Average Yield from 2004/2005 *Aviso Prévio* and 2005 TIA, by Province

Province	Total Area Planted (Ha.) – Small and Medium-Size Farms			Yield (Tons) per Ha. – Small and Medium-Size Farms			Total Production (Tons) - Small and Medium-Size Farms			Total Production (Tons)		% AP Commercial Production
	AP	TIA	% Diff.	AP	TIA	% Diff.	AP	TIA	% Diff.	AP-Commercial	AP Total (including households)	
Niassa	146,880	189,325	-22.4%	1.488	0.643	131.4%	218,557	121,748	79.5%	1,703	220,260	0.8%
Cabo Delgado	89,162	126,017	-29.2%	1.494	0.638	134.3%	133,197	80,363	65.7%	6,514	139,711	4.7%
Nampula	122,829	157,451	-22.0%	1.234	0.651	89.5%	151,553	102,544	47.8%	3,517	155,070	2.3%
Zambézia	222,920	327,776	-32.0%	1.100	0.546	101.6%	245,115	178,811	37.1%	4,076	249,191	1.6%
Tete	181,453	281,505	-35.5%	0.969	0.618	56.8%	175,803	173,989	1.0%	3,242	179,045	1.8%
Manica	217,393	222,637	-2.4%	0.781	0.729	7.2%	169,723	162,199	4.6%	8,276	177,999	4.6%
Sofala	95,624	109,554	-12.7%	0.807	0.481	67.9%	77,175	52,651	46.6%	8,049	85,224	9.4%
Inhambane	119,874	112,912	6.2%	0.313	0.160	96.2%	37,529	18,013	108.3%	152	37,681	0.4%
Gaza	136,444	191,631	-28.8%	0.251	0.213	17.7%	34,199	40,818	-16.2%	20,756	54,955	37.8%
Maputo	62,815	30,726	104.4%	0.402	0.338	18.6%	25,227	10,400	142.6%	7,307	32,534	22.5%
Total	1,395,394	1,749,534	-20.2%	0.909	0.538	68.9%	1,268,078	941,536	34.7%	63,591	1,331,670	4.8%

Table 2. Comparison of Household-Based Rice Production and Average Yield from 2004/2005 *Aviso Prévio* and 2005 TIA, by Province

Province	Total Area Planted (Ha.) – Small and Medium-Size Farms			Yield (Tons) per Ha. – Small and Medium-Size Farms			Total Production (Tons) -Small and Medium-Size Farms			Total Production (Tons)		% AP Commercial Production
	AP	TIA	% Diff.	AP	TIA	% Diff.	AP	TIA	% Diff.	AP- Commercial	AP Total (including households)	
Niassa	4,927	5,878	-16.2%	0.881	0.263	234.7%	4,341	1,547	180.6%	43	4,384	1.0%
Cabo Delgado	15,372	38,228	-59.8%	1.159	0.282	311.7%	17,823	10,765	65.6%	216	18,039	1.2%
Nampula	37,781	28,119	34.4%	0.993	0.223	345.3%	37,518	6,271	498.3%	131	37,649	0.3%
Zambézia	88,678	158,181	-43.9%	0.507	0.187	171.6%	44,960	29,528	52.3%	978	45,938	2.1%
Tete	322	1,591	-79.8%	0.355	0.148	140.5%	114	235	-51.3%	0	114	0.0%
Manica	790	3,246	-75.7%	0.000	0.229	-	0	742	-	790	790	100.0%
Sofala	31,030	24,943	24.4%	0.000	0.141	-	0	3,509	-	670	670	100.0%
Inhambane	3,657	5,972	-38.8%	0.000	0.261	-	0	1,560	-	4	4	100.0%
Gaza	2,360	11,789	-80.0%	1.203	0.835	44.0%	2,839	9,844	-71.2%	3,132	5,971	52.5%
Maputo	2,130	423	404.1%	0.344	1.499	-77.1%	732	633	15.5%	320	1,052	30.4%
Total	187,048	278,368	-32.8%	0.579	0.232	149.4%	108,328	64,635	67.6%	6,284	114,612	5.5%

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Table 3. Comparison of Household-Based Sorghum Production and Average Yield from 2004/2005 *Aviso Prévio* and 2005 TIA, by Province

Province	Total Area Planted (Ha.) – Small and Medium-Size Farms			Yield (Tons) per Ha. – Small and Medium-Size Farms			Total Production (Tons) -Small and Medium-Size Farms			Total Production (Tons)		% AP Commercial Production
	AP	TIA	% Diff.	AP	TIA	% Diff.	AP	TIA	% Diff.	AP-Commercial	AP Total (including households)	
Niassa	42,490	22,384	89.8%	0.784	0.295	165.9%	33,294	6,596	404.7%	0	33,294	0.0%
Cabo Delgado	70,876	68,503	3.5%	0.790	0.445	77.6%	56,012	30,477	83.8%	113	56,126	0.2%
Nampula	0	50,481	-	-	0.331	-	91,789	16,710	449.3%	114	91,903	0.1%
Zambézia	71,190	44,441	60.2%	0.568	0.272	108.6%	40,434	12,103	234.1%	5	40,439	0.0%
Tete	64,376	41,957	53.4%	0.290	0.221	31.5%	18,676	9,256	101.8%	68	18,743	0.4%
Manica	50,847	67,455	-24.6%	0.420	0.330	27.5%	21,377	22,242	-3.9%	48	21,425	0.2%
Sofala	65,784	57,372	14.7%	0.655	0.288	127.5%	43,117	16,531	160.8%	399	43,516	0.9%
Inhambane	24,801	6,686	270.9%	0.362	0.055	555.1%	8,968	369	2329.9%	0	8,968	0.0%
Gaza	4,699	5,076	-7.4%	0.120	0.049	144.3%	564	249	126.2%	0	564	0.0%
Maputo	0	13	-	0.000	0.000	0.0%	0	0	0.0%	0	0	0.0%
Total	395,065	364,370	8.4%	0.795	0.314	153.0%	314,232	114,534	174.4%	747	314,979	0.2%

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Table 4. Comparison of Household-Based Millet Production and Average Yield from 2004/2005 *Aviso Prévio* and 2005 TIA, by Province

Province	Total Area Planted (Ha.) – Small and Medium-Size Farms			Yield (Tons) per Ha. – Small and Medium-Size Farms			Total Production (Tons) -Small and Medium-Size Farms			Total Production (Tons)		% AP Commercial Production
	AP	TIA	% Diff.	AP	TIA	% Diff.	AP	TIA	% Diff.	AP-Commercial	AP Total (including households)	
Niassa	2,043	1,755	16.4%	0.702	0.216	225.1%	1,434	379	278.3%	0	1,434	0.0%
Cabo Delgado	4,780	1,482	222.5%	0.687	0.232	196.3%	3,285	344	855.6%	0	3,285	0.0%
Nampula	7,286	1,668	336.8%	0.595	0.360	65.4%	4,335	600	622.6%	0	4,335	0.0%
Zambézia	15,303	5,345	186.3%	0.426	0.453	-5.9%	6,520	2,419	169.5%	0	6,520	0.0%
Tete	31,661	23,424	35.2%	0.291	0.303	-4.1%	9,203	7,101	29.6%	0	9,203	0.0%
Manica	14,815	5,761	157.2%	0.238	0.264	-9.8%	3,525	1,520	131.9%	0	3,525	0.0%
Sofala	13,443	6,810	97.4%	0.343	0.318	7.9%	4,609	2,164	112.9%	0	4,609	0.0%
Inhambane	11,631	2,403	383.9%	0.149	0.056	166.3%	1,735	135	1188.7%	0	1,735	0.0%
Gaza	1,328	5,274	-74.8%	0.195	0.118	65.5%	259	623	-58.3%	0	259	0.0%
Maputo	0	3	-	0.000	0.000	0.0%	0	0	0.0%	0	0	0.0%
Total	102,289	53,927	89.7%	0.341	0.283	20.4%	34,906	15,285	128.4%	0	34,906	0.0%

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Table 5. Comparison of Estimates of Total Number of Farm Households and Cereal Production from 2004/2005 *Aviso Prévio* and 2005 TIA, by Province

Province	Total Number of Farm Households			Total Production (Tons) - Small and Medium-Size Farms			Total Production (Tons)		% AP Commercial Production
	AP	TIA	% Diff.	AP	TIA	% Diff.	AP-Commercial	AP Total (including households)	
Niassa	220,324	186,025	18.4%	257,627	130,271	97.8%	1,746	259,373	0.7%
Cabo Delgado	390,588	360,762	8.3%	210,318	121,949	72.5%	6,843	217,161	3.2%
Nampula	823,979	732,062	12.6%	285,196	126,125	126.1%	3,762	288,957	1.3%
Zambézia	821,146	765,384	7.3%	337,030	222,861	51.2%	5,058	342,088	1.5%
Tete	300,118	287,942	4.2%	203,796	190,581	6.9%	3,310	207,106	1.6%
Manica	193,172	212,861	-9.2%	194,626	186,702	4.2%	9,114	203,740	4.5%
Sofala	225,844	177,001	27.6%	124,900	74,855	66.9%	9,118	134,018	6.8%
Inhambane	267,341	277,370	-3.6%	48,232	20,077	140.2%	156	48,388	0.3%
Gaza	236,899	252,847	-6.3%	37,861	51,534	-26.5%	23,888	61,749	38.7%
Maputo	95,087	80,549	18.0%	25,959	11,034	0.0%	7,627	33,586	22.7%
Total	3,574,499	3,332,803	7.3%	1,725,544	1,135,989	51.9%	70,621	1,796,166	3.9%

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ANNEX VII

Livestock Statistics

The Directorate of Veterinary Services is one of the main users of the statistics on livestock. They need different types of information at different levels for planning policies and programs and for operational purposes. Their main source of information on livestock is currently the TIA, although at the district level some provinces also maintain a frame of livestock producers (*arrolamento*) with a cattle headcount which is updated periodically. The Directorate of Veterinary Services finds the TIA results reasonable for smaller animals (goats, chickens, etc.), since they are more evenly distribution among farmers. However cattle are more concentrated in certain regions, and a significant proportion of cattle is concentrated in large and medium-size operations, resulting in higher sampling variability in the results from the Censo Agro-Pecuário (CAP) and TIA. This contributes to a larger discrepancy between the CAP and TIA results and the figures from the *arrolamento*.

For the calculation of cattle vaccination rates and other rates for different services, the TIA will continue to be the most reliable source of information, because it is important that the numerator and denominator of these rates come from the same sample population. When the denominators are derived from independent estimates, the rates can be considerably biased. The TIA is the most important source of official statistical information on the total number of livestock at the national and provincial levels, as well as the distribution of cattle into different categories (bulls, heifers, calves, etc.). For example, the relative distribution of the cattle by category from TIA can be applied to the headcounts from the *arrolamento* at the provincial and district levels for planning services and operations at the local level.

In the past (prior to the year 2000) the *arrolamento* was conducted regularly in the provinces, and this had been the main source of information on cattle. However, this data collection system was abandoned after 2000, when the CAP and TIA became the main sources of official statistics on cattle. However, in cases where the *arrolamento* continues to be implemented differences in the estimates of the total number of cattle has led to confusion among some users such as the Directorate of Veterinary Services. Therefore there is an important need for aligning the different sources of information on cattle.

Fortunately the *Instituto Nacional de Estatística* (INE) will be conducting the next Mozambique Census of Population and Housing in August 2007. The census form includes a small set of questions on agricultural and livestock activities, including a question on the total number of cattle. Since the census form will be administered to each household in Mozambique, the census data should provide a national headcount of cattle down to the lowest geographic units (for example, aldéias). Given the importance of this information, the Ministry of Agriculture should be providing advocacy for cooperation with the census at all levels, especially the farmers who will be providing the census information. This is an opportunity that occurs once a decade to obtain an accurate inventory of livestock. The next CAP in 2009 will use this information for developing a sampling frame, but the CAP data collection will be based on a sample, similar to the 1999/2000 CAP.

The 2007 Census can also be used for developing a directory of large-scale cattle farms (for example, with 100 or more head of cattle), which will need to be completed with information from other sources at the district and provincial levels such as the extension agents and Ministry livestock service providers, and continuously updated over time. This directory should include livestock enterprises or farms that are not household-based. The directory of large-scale cattle farms will be important both for the livestock service providers at the district level as well as for improving the sampling efficiency and reliability of results for the CAP and TIA.

Given the different information requirements at the national and local levels, it is recommended to re-establish and improve the district-level *arrolamento* or a similar inventory system for planning operations and services at the local level, and to continue collecting livestock information in TIA, so that initially there will be two parallel systems that can be used for validation and providing the most accurate results at critical times for each geographic level. These two sources of information will be aligned over time as the statistical system develops.

Although the *arrolamento* can provide timely information for improving the operations and services at the district level, it will take a long time to implement a system for validating and aggregating such data to higher levels in a timely manner. In order to aggregate such community-level statistics to higher levels, it will be necessary to implement the following components of the system over time:

- A complete frame of non-overlapping administrative or service area units has to be established for developing the list of cattle producers for the *arrolamento*. The 2007 Mozambique Census will be useful for developing this complete geographic frame.
- Procedures need to be established for compiling a complete list of cattle producers within each local reporting unit. In order to ensure that this directory is complete, information should be obtained from various sources, including the 2007 Census, farming associations, extension agents and veterinary services. Comprehensive training needs to be provided at all levels to make this effective. It is important to have an active involvement of livestock officers in the planning and preparation activities of the CAP and TIA, as well as for field supervision.
- Procedures need to be developed for periodic reporting and updating the inventory of cattle. For example, this could be done at dipping stations or veterinary service points, but there should be outreach to obtain information for the cattle producers who do not have access to these services. Again, training is a key element to the success of this activity.
- The districts need to obtain timely information on the number of livestock from each of the administrative or reporting units. They need to validate the completeness of this information.
- The province needs to obtain timely information from each district, validate the completeness of this information and send it quickly to the Ministry in Maputo, where the final national estimates will be produced.

It will take a long time to implement this system and streamline the different activities so that the final national figures on cattle production are available in time for the evaluation of the PES and other purposes. For this reason the TIA will remain the main source of data for the official statistics until the alignment to the two systems is complete. TIA is also important for obtaining information on meat and milk production, at the national and provincial levels.

It will also be necessary to improve the reliability of the cattle estimates from TIA by increasing the sampling efficiency with a more complete list of large cattle farms to be included with certainty, and through improved stratification of the sampling frames for the 2009 CAP and future TIA surveys.

ANNEX VIII

MINISTRY OF AGRICULTURE MANDATES:

Organizational Statute of the Ministry of Agriculture

Chapter II

Functions:

Article 5

National Directorate of Agrarian Services

1. **The National Directorate of Agrarian Services is responsible for the following areas:**

a) Agricultural and livestock production;

b) Protecting health of livestock and plants;

c) Early warning;

d) Seeds, seedling and planting materials;

e) Genetic conservation and improvement, and genetic registration and patents;

f) Irrigation;

g) Coordination of food security;

2. **The National Directorate of Agrarian Services has as functions:**

a) To assure the elaboration, implementation, monitoring and evaluation of policies, strategies and legislation;

b) To promote the collection of information, and the conduct of surveys, inventories and studies, and provide the subordinated institutions and the local institutions with relevant technical information;

c) To promote the development of the private sector and producers' organizations, namely, cooperatives, unions, associations, management committees and others, and their participation in the development and implementation of strategies and legislative policies;

d) To stimulate the private sector activities, according to the law;

e) To promote the mechanization and processing of the agricultural and livestock production;

f) To promote the construction and utilization of irrigation systems;

g) To promote the "fiscalization" monitoring activity.

Article 9

Directorate of Economics

The Directorate of Economics has as functions:

a) To formulate, monitor and evaluate policies, strategies, programmes, plans, projects and directives for governmental action in the agricultural sector;

b) To evaluate the effects the national and international macro-economic policies for the agricultural production and propose actions within the scope of MINAG;

c) To elaborate, update and harmonize the MINAG annual and multi-year plans and coordinate the periodic monitoring and evaluation of its implementation;

d) To coordinate the preparation of the annual and multi-year budgets for projects of MINAG;

e) To collaborate with the governmental bodies and other institutions in the formulation of directives, policies and action strategies in the areas of rural credit, fiscal incentives and fixing of minimum prices in the agriculture sector;

f) To produce and disseminate statistics for following, evaluating and monitoring the system of agricultural production;

g) To ensure the installation, functioning and maintenance of the information technology and the electronic communications of MINAG.

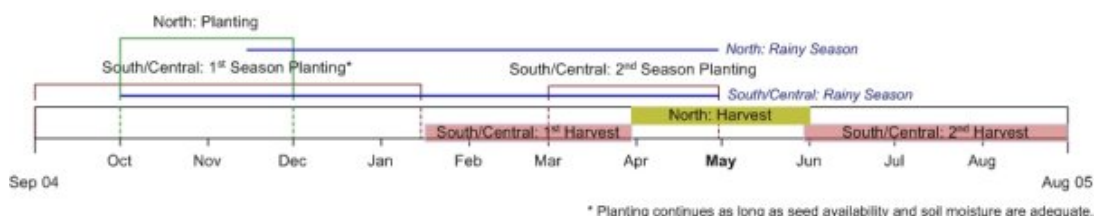h) Develop reports for activities of the sector

ANNEX IX

Table of Standard Errors, Coefficients of Variation and 95% Confidence Intervals for TIA 2005 - Estimates of Total Corn Production (Tons) by Province

Province	Estimate	S.E.	CV (%)	95% Conf. Interval Lower	Upper
Niassa	121,748	11,090	9.1	100,008	143,488
Cabo Delgado	80,363	6,156	7.7	68,295	92,431
Nampula	102,544	7,936	7.7	86,987	118,100
Zambézia	178,811	13,924	7.8	151,514	206,107
Tete	165,919	12,814	7.7	140,800	191,038
Manica	162,180	16,496	10.2	129,842	194,518
Sofala	52,651	4,352	8.3	44,119	61,182
Inhambane	18,013	1,936	10.7	14,217	21,809
Gaza	40,818	4,674	11.5	31,656	49,982
Maputo	10,400	1,276	12.3	7,899	12,902

ANNEX X

Calendar of Agricultural Cycles and Survey Activities by Region

It is very important to establish a calendar of data collection activities and release of key survey results for the integrated *Aviso Prévio* and TIA. First it is necessary to examine the calendar of agricultural cycles by region in order to determine the most effective timing of each activity. The following graphic illustrates the calendar for the two crop seasons between September 2004 and August 2005, copied from a FEWS-NET bulletin.

North: Planting

South/Central: 1st Season Planting*

North: Rainy Season

South/Central: 2nd Season Planting

South/Central: Rainy Season

South/Central: 1st Harvest

North: Harvest

South/Central: 2nd Harvest

Sep 04   Oct   Nov   Dec   Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Aug 05

* Planting continues as long as seed availability and soil moisture are adequate.

Based on this agricultural cycle and the requirements of the key data users, we recommend the following calendar of survey activities and release of key survey results:

Activity	Region	Proposed schedule
1. Select integrated sample of agricultural households for TIA and *Aviso Prévio*	All	August
2. *Aviso Prévio* – First early warning crop production forecast based on rainfall predictions	All	October
3. *Aviso Prévio* - Monitor crop planting and conditions, measure crop area planted, select plots for crop-cutting, interview sample households using qualitative questionnaires	South Central/North	November December
4. *Aviso Prévio* – Second early warning crop production forecast based on area planted and modeling based on rainfall, soil and other conditions	All	January
5. *Aviso Prévio* – Crop cutting, measure crop area harvested, complete quantitative questionnaires	South Central/North	Feb./March April/May
6. *Aviso Prévio* – Quick crop forecast from joint mission, FAO/WFP/MINAG	All	April/May
7. *Aviso Prévio* – Final crop forecast based on crop cuttings, other information	All	May/June
8. TIA – preparation of questionnaire, manuals, training, logistics	All	April/June
9. TIA – Begin data collection	South Central/North	July August
10. TIA – End data collection	All	October

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11. TIA – Preliminary results for total crop and livestock production released for PES evaluation and National Accounts	All	December
12. TIA – Final results published; officially delivered to INE	All	March
13. TIA – Final microdata files with metadata available for data users; dissemination seminar	All	March/April