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Global Strategy to Improve Agricultural and Rural Statistics
Report of the Friends of the Chair on Agricultural Statistics

Prepared by the World Bank

Global Strategy to Improve Agricultural and Rural Statistics

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Preface

The Global Strategy to Improve Agricultural and Rural Statistics is based on input from a large number of stakeholders including national statistical institutes and ministries of agriculture, plus regional and international organizations.

One of the outcomes of the 2007 International Statistical Institute Conference on Agricultural Statistics were that there was not only a lack of direction regarding agricultural data requirements posed by the Millennium Development Goals and other emerging issues such as the use of food for bio fuels, the environment and food security, but that these were accompanied by a general decline in the overall quality and availability of agricultural statistics.

These concerns were discussed at a meeting of interested parties during the 2008 meeting of the UN Statistical Commission. This led to a working group being formed to draft a strategic plan to improve agricultural statistics. This working group, under the

guidance of the UN Statistics Division, included the World Bank, FAO, Eurostat, the US Department of Agriculture, and the International Statistical Institute.

Using input from the working group and other stakeholders, the World Bank prepared a paper entitled "Framework to Develop a Strategic Plan to Improve National and International Agricultural Statistics".

This paper was the basis for the Expert Meeting on Agricultural Statistics held in Washington, DC on 22 and 23 October, 2008. This meeting was attended by heads and representatives of national statistical offices or ministries of agriculture from 27 countries and also included the FAO, the World Bank, IMF, Eurostat, OECD, and the US Department of Agriculture. The outcomes of this meeting formed the basis for a paper discussed at the 2009 meeting of the UNSC. The conclusion of the UNSC was consensus on the current unsatisfactory situation of agricultural statistics and the need for a *Global Strategy* to make the necessary improvements.

The UNSC also recommended a Friends of Chair Working Group (FoC) be formed to develop the global strategy for review and approval at the 41st meeting of the commission in 2010. The Friends of the Chair group is led by Brazil (Mr. Eduardo Pereira Nunes) and includes Australia, Brazil, China, Cuba, Ethiopia, Italy, Morocco, Philippines, Russian Federation, Trinidad and Tobago, Uganda, United States, FAO and UNSD both serving as observer and secretariat, Eurostat (observer) and the World Bank (observer).

With input from the FOC and other stakeholders, the World Bank developed a draft "Global Strategy to Improve Agricultural Statistics" in collaboration with FAO. This paper was the basis for the ISI Satellite Meeting on Agricultural Statistics that took place 13 and14 August in Maputo, Mozambique. The Meeting, completely dedicated and organized around the chapters of the Global Strategy, was attended by more than 200 participants from over 45 countries as well as regional and international organizations. Funding agencies such as the Bill and Melinda Gates Foundation also showed their interest by sending delegates to the meeting to discuss possibilities and modalities for participating in this global initiative. Based on input from this meeting, the Friends of Chair formed four working groups to provide more input about several components of the paper through consultations in the network of statisticians.

The International Statistical Institute (ISI) conference in Durban (15-22 August 2009) that followed Maputo Meeting discussed a wide variety of invited and contributed papers on agricultural and rural statistical issues related to the Global Strategy, covering topics such as censuses of agriculture, survey methods, economic-environmental accounting for agriculture. These sessions over all included an estimated 300 hundred participants. Furthermore the review of agricultural statistics in the UNECE region explicitly recognised the importance of the enhancement of agricultural statistics in developing countries

In parallel, FAO took the initiative to also include the Strategy as a main item on the agendas of its bi-annual Conference of November 2009 (which gathers Ministers of Agriculture from all Member Countries) and Sessions of the Regional Commissions on Agricultural Statistics (National Directors of Agriculture Statistics).

The Paris 21 Consortium meeting in Dakar (November 2009) provided another opportunity to further discuss the Global Strategy with a variety of stakeholders, donors in statistical cooperation, governments, private business and intermediate organisations and statisticians. A lunch time seminar on the Global Strategy attracted around 100 participants and contributed significantly to the further recognition of the importance of this Global Strategy. The World Bank Peer Review also provided input to the Global Strategy

Efforts to expand the access to the development of the Global Strategy to all ministries of agriculture and national statistical offices included the development of a Wikipedia web page: *wiki.asfoc.ibge.gov.br*. This global consultation helped the Friends of Chair group to improve the document and widely publicize the initiative.

The Global Strategy, available as a background document to this session of the Statistical Commission, is therefore the result of a wide consultation process with national and international statistical organisations as well as with agricultural ministries and other governmental organisations represented in FAO governing bodies.

Acknowledgements

The Global Strategy to Improve Agricultural and Rural Statistics was prepared by the World Bank in collaboration with the Food and Agricultural Organization of the United Nations, (FAO) Friends of the Chair working groups, and extensive consultations with stakeholders.

The World Bank team was led by Sanjiva Cooke and included Nwanze Okidegbe and Fred Vogel (principal author). The team is grateful for comments received from the following peer reviewers: Gerald Nelson, Gero Carletto, Robert Townsend, and Mary Ahearn.

The FAO team led by Pietro Gennari included Naman Keita, Hiek Som, and Xiaoning Gong. The Friends of the Chair on Agricultural Statistics provided valuable input from a national perspective. It was led by Eduardo Pereira Nunes (Brazil) and included representatives from Australia, China, Cuba, Ethiopia, Italy, Morocco, Philippines, Russian Federation, Trinidad and Tobago, Uganda, United States, FAO, the UN Statistics Division, Eurostat, and the World Bank.

Special recognition needs to be given to the Mozambique national statistical office that hosted the International Statistical Institute Satellite Meeting on Agricultural Statistics.

The meeting was organized in cooperation with the African Development Bank (AfDB), the Statistical Office of the European Communities (Eurostat), the Food and Agriculture Organization of the United Nations (FAO), the Partnership in Statistics for Development in the 21st Century (PARIS21), the United Nations Statistics Division (UNSD), the United States Department of Agriculture (USDA), and the World Bank

The International Statistical Institute's (ISI) support of the global initiative to improve agricultural statistics has been greatly appreciated. This ISI conference brought together about 200 experts who focused their discussions on the Global Strategy and provided the input leading to the final report.

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Executive Summary

Policy makers at the national and international level and those developing investment strategies to enhance economic development face many challenges with the changing face of agriculture in the 21st century. While agriculture is the primary source to feed, clothe, and provide materials for fuel and housing for a growing world population, the challenge is at the same time to lift millions of people out of poverty and hunger, reduce the impact of agriculture on the environment and global warming, and sustain water and land resources. These are issues that go beyond national boundaries.

The purpose of the global strategy is to provide the framework for national and international statistical systems to produce the basic data and information to guide the decision making required for the 21st century. This Global Strategy is based on three pillars:

- The first pillar is the establishment of a minimum set of core data that countries will provide to meet the current and emerging demands.
- The second pillar is the integration of agriculture into the national statistical systems in order to meet policy maker and other data user expectations that the data will be comparable across countries and over time. The integration will be achieved by implementing a set of methodology that includes the development of a Master Sample Frame for Agriculture, the implementation of an Integrated Survey Framework, and with the results available in a Data Management System.
- The Third Pillar is the foundation that will provide the sustainability of the agricultural statistics system through governance and statistical capacity building.

The global strategy is based on a thorough assessment of data user needs and what is currently available. This revealed that not only is there a serious decline in the quantity and quality of agricultural statistics, it is occurring at the same time many new data requirements are emerging. These emerging data requirements include issues surrounding agriculture including poverty and hunger, global warming, the use of land and water, and the increasing use of food/feed commodities to produce biofuels.

These data requirements led to defining a conceptual framework that provides an overview of the economic, social, and environmental dimensions of agriculture. This conceptual framework brings forestry, fisheries, and land and water use into the agricultural and rural framework. The conceptual framework and data requirements call for a linkage between the household, the agricultural holding, and the land they occupy. The scope and coverage of agricultural production and activities is outlined.

The assessment of national agricultural statistical systems in the context of the conceptual framework points to an urgent need to improve the statistical capacity of countries to rebuild their capabilities to meet the new challenges. The assessment also showed a need to improve the coordination between national statistical organizations and other agencies producing agricultural statistics.

A menu of indicators is provided to define the data that the statistical system should provide. From this menu, a subset of core data or statistics is selected for the national annual statistical program that will provide the input to estimate the necessary indicators. This minimum set of core data is identified to be used as a starting point to build agricultural statistics systems for the 21st century. A strategy to determine the content, coverage, and frequency of the national system that goes beyond the core set of data is provided.

The emerging data requirements, the conceptual framework, the assessment of the national agricultural statistics systems, and the choice of a core set of indicators all point to the need to integrate agriculture into the national statistical system. The strategy identifies the main elements upon which the integration will be achieved. The integration of agriculture into the national statistical system will begin with the development of a master sample frame for agriculture which will be the foundation for all data collections based on sample surveys or censuses. The master sample frame is to built on the requirements to include both households and farms as statistical units and provides a linkage between the census framework and land use. An integrated survey framework will be established to provide data measured consistently across time and comparable across countries using an annual survey of selected core items and rotating panels covering economic and environmental issues. The concept of a master sample frame will be extended to include a data management system for all official statistics related to agriculture.

The basic principles are that all data collections will be based on sample units selected from the master sample frame, data collections integrated into the survey framework, and the resulting official statistics residing in the data management system. The survey framework also takes into account the additional data sources that need to be included in the integrated statistical system including administrative data, agribusiness and market information systems, community surveys, remote sensing, and consistent input from “expert data collections”.

These principles will affect the governance at the national level where the effort to integrate agriculture will affect the roles of the national statistical organizations, the ministries of agriculture, and those from other sectors. The strategy suggests each country establish a national statistical council to coordinate the inclusion and integration of agriculture when designing the National Strategies for the Development of Statistics (NSDS). However, the strategy leaves the respective roles of the organizations to the countries to decide.

The steps to implement the strategic plan will depend upon the statistical capacity of each country. Those needing to reform their statistical system will begin with the core data items and build the rest over time. The next group is the countries with National Strategies for the Development of Statistics being implemented. These national strategies need to be reviewed in light of the strategic plan and revised if necessary. The third group includes the countries with developed statistical systems. However, many of these do not meet the integration requirement and will need to begin by developing a master sample frame for agriculture and an integrated data base.

The *Global Strategy* is the result of an extensive consultation process with national and international statistical organizations as well as with agricultural ministries and other governmental institutions represented in FAO governing bodies. Considerable input came from the United Nations Statistical Commission Friends of Chair working group and the 2009 meetings of the International Statistical Institute in Maputo and Durban, Africa. Other collaborations came from the FAO Conference and Regional Commissions on Agricultural Statistics, the World Bank peer review and the development of a Wikipedia web page to collect inputs from the statistical community. (wiki.asfoc.ibge.gov.br)

The strategy is a long term effort with its implementation proceeding in stages that will depend upon each country's initial statistical capacity. Given the dynamic nature of agriculture and accompanying issues, the strategy should be considered to be a living document to be updated when needed to reflect current situations. It will be followed by an implementation plan based on input from the national and international partners and additional input received. The implementation plans will be flexible to consider the specific country situations.

This paper presents the overall strategy. The *Global Strategy* provides a ground-breaking effort to improve agricultural statistics that has implications for other sectors in the national statistical system. While it took many years for agriculture statistics to erode to the current situation, the implementation provides a fresh start.

Chapter 1: Introduction

The availability and quality of agricultural statistics has declined, just at the wrong time

1. Three out of four poor people in developing countries live in rural areas. Most directly or indirectly depend on agriculture for their livelihoods. According to the *World Development Report (2008*), agriculture is recognised as a vital development tool for achieving the Millennium Development Goals (MDGs), especially contributing to food security, raising the incomes of the poor, facilitating economic transformation, and providing environmental services. This recognition has led to a renewal of the international community's commitment[1] [1]to agriculture and has been amplified by a new urgency driven by a changing global context[22]. Over the past five years, droughts in grain-producing nations, increased oil prices, and sales of corn to produce biofuels have contributed to skyrocketing food prices and lower quantities of food reserves. Global food prices more than doubled from 2006 to mid-2008 and future prices are expected to remain higher than in the 1990s and likely to be more volatile. In addition, climate change, greater demand from a growing world population as well as the global economy, and the financial landscape have all contributed to a sharpened focus on agricultural and rural development. These developments have renewed attention on agricultural performance and measurement of results.

2. However, one of the development challenges is the paucity of data upon which to assess the efficacy of the policies and commitments to agriculture. Decisions about aid and/or investment efforts to foster agricultural growth need to be based on sound information on land use, factors of agricultural production, and the prevailing economic and social situation faced by producers. These decisions need to be made under a broader framework that takes into account the different variables that affect the environment and influence global warming and the overall production

[1] See for instance: "The Comprehensive African Agriculture Development Programme" www.nepad-caad.net; "Joint Donor Principles for Agriculture and Rural Development Programs", The Global Donor Platform for Rural Development, 2009; "World Development Report, Agriculture for Development", the World Bank 2008

[2] See for instance, "G20 asks World Bank to create agriculture fund", Reuters, September 25,2009.

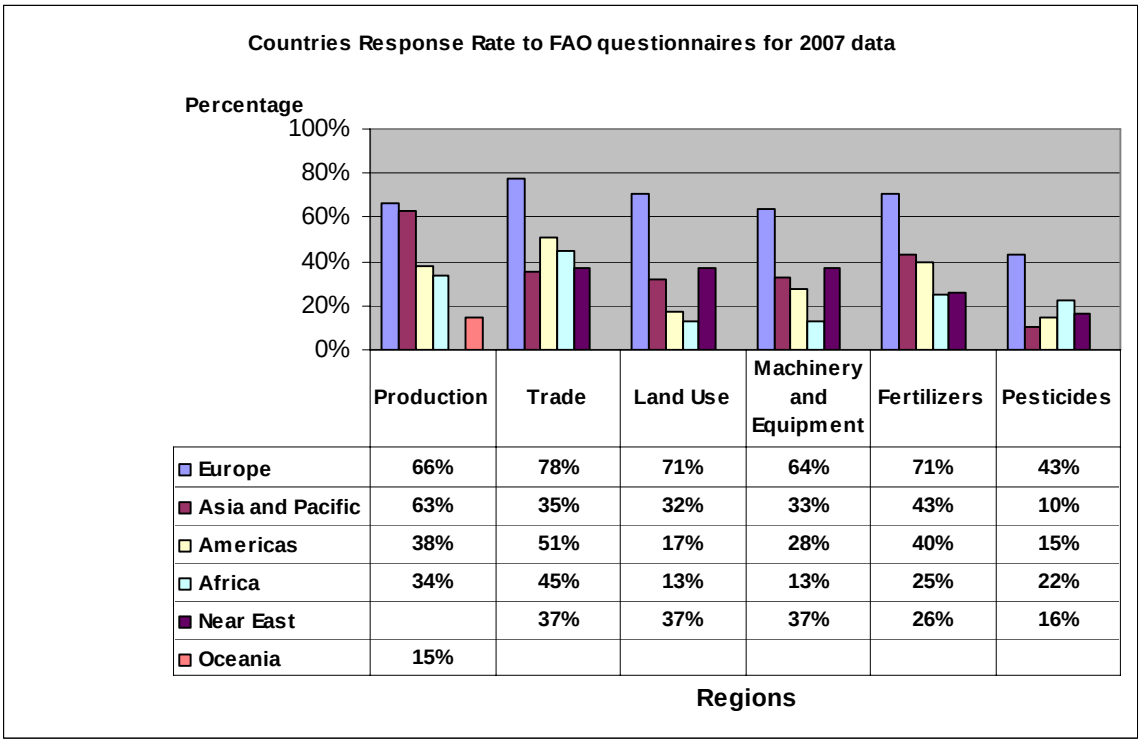
systems. The overall impact of these factors can only be effectively measured and evaluated with appropriate statistics. The reality is that there is a lack of a comparable minimum set of agricultural data, and that many countries lack the capacity to produce and report the necessary data to monitor their national trends or inform the international development debate.

The decline in the availability and quality of statistics

3. At the same time data requirements are increasing, the assessment of current statistical capacity reveals that a large number of countries, especially in the developing world are not able to meet even the most basic data requirements. The *Independent External Evaluation of the s Food and Agriculture Organization of the United Nations (2005*) stated that "the time has come for a total re-examination of the statistical needs for the 21st century and how they can best be met." As a result, an evaluation was commissioned targeted at the FAO's work and role in statistics. The*t evaluation* concluded that "the quantity and quality of data coming from national official sources has been on a steady decline since the early 1980s, particularly in Africa". The Report also indicates that "official data submissions from countries in Africa are at their lowest level since before 1961, with only one in four African countries reporting basic crop production data". These findings and conclusions are confirmed by recent assessment studies. The evaluation also recognized the increasing demands for new statistics and the need to integrate data on agriculture, fisheries, and forestry to understand their effects on the environment, climate change, and the use of biofuels to deal effectively with policy issues.

4. There is a widening gap between data requirements and data availability and quality in many developing countries. The figure below presents the response rates to the questionnaires sent by FAO to countries by data domain (production, land use, agricultural machinery, trade, fertilizer and pesticides) and by region. Response rates from the Pacific, Africa (except for trade and pesticides data) and near East are the lowest while Europe has the highest rates. Response rates from Latin America for basic data on production, land use, machinery, and pesticides are also very low.

Figure 1: Country Response to the FAO--2007



	Production	Trade	Land Use	Machinery and Equipment	Fertilizers	Pesticides
Europe	66%	78%	71%	64%	71%	43%
Asia and Pacific	63%	35%	32%	33%	43%	10%
Americas	38%	51%	17%	28%	40%	15%
Africa	34%	45%	13%	13%	25%	22%
Near East		37%	37%	37%	26%	16%
Oceania	15%					

Factors contributing to the decline

5. There are likely several reasons for this decline in the quantity and quality of agricultural and rural development statistics. One obvious reason is country-level capacity at public statistical agencies. For example, a major conclusion of the 2008 FAO evaluation is that the most pressing need in the statistical system is to improve the capacity for agricultural statistics at the country level, describing this need as a "re-emerging" need. The current situation is the result of several factors, including a lack of donor interest and a parallel decline in priority and resources at the national level. Also, the emerging data needs (impact of agriculture on environment; investment in agriculture; bio fuels; water and land use, etc.) require a new conceptual framework which goes beyond the traditional domains of agricultural statistics.

6. Not unrelated to the lack of capacity is the lack of financial resources to collect data. The dilemma is that agricultural statistics are often outside the national statistical system with Ministries of Agriculture and other organizations responsible for sectors such as land, water use, fisheries, and forestry also failing to keep up with the increasing demand for data.

7. Various studies done recently, in particular the report of the Independent Evaluation of FAO's Role and Work in Statistics prepared in 2008, found that national statistical capacity for agricultural statistics has significantly deteriorated over the last decades. Many developing countries, especially in Africa, do not have at the moment the capacity to collect even the most basic production statistics, although that capacity existed in the 1970s.

8. The FAO evaluation report found that the quantity and quality of data coming from national official sources has been on a steady decline since the early 1980s, and that official data submissions to FAO from African countries are at their lowest level since before 1961.

9. One of the most important factors contributing to the weakness of agricultural statistics system in many countries is that agricultural statistics is not adequately integrated into the National Statistical System. In many countries with decentralized statistical systems, there is a lack of coordination between the National Statistical Office and Ministry of Agriculture. Also, National Strategies for the Development of Statistics do not adequately cover the agricultural sector.

10. A recent review by the Partnership in Statistics for Development in 21st century (PARIS21) found that, of a total of 78 International Development Association (IDA) countries, 43 (55%) have a strategy for the development of statistics where agriculture is or is supposed to be included. Among these 43 IDA countries, only 4 to 10 countries (therefore only around 10% of all IDA countries in the world) have included agriculture more or less appropriately in the NSDS process. (2009)

11. The following main problems are common to many developing countries:

- limited staff and capacity of the units that are responsible for collection, compilation, analysis, and dissemination of agricultural statistics;
- lack of adequate technical tools, statistical methodology and survey framework to support data production efforts;
- insufficient funding allocated for agricultural statistics from development partners and national budgets;
- lack of institutional coordination which results in the lack of harmonized and integrated data sources;
- lack of capacity to analyse data in a policy perspective which results in a significant waste of resources as large amounts of raw data are not properly used;
- difficult for data users to access existing data with no metadata and indication of quality.

12. A detailed and systematic country assessment study is needed using a standard international framework to provide a detailed diagnosis and analysis of country profiles regarding the main data domains, including data gaps, data quality, and related institutional and methodological limitations with regards to priority data needs.

13. However, with information available, it can be concluded that Africa, the Near East, the Pacific, and Latin America have the largest number of countries with weak agricultural statistics systems and that a comprehensive capacity development effort is needed to strengthen and upgrade the capacity of countries in these regions to enable them to meet the minimum data requirements.

Filling the void: The Global Strategy to improve agricultural and rural statistics

14. The Global Strategy provides a blue print for a coordinated and long term initiative to address the decline in agricultural statistics systems. Several efforts related to the goal to improve agricultural statistics provided valuable input to the development of the *Global Strategy.* These include; *Tracking results in agriculture and rural development in less than ideal conditions-Source Book of Indicators for Monitoring and evaluation (World Bank- 2008), The World Programme for the Census of Agriculture (FAO- 2005), The Guide to Designing a National Strategy for the Development of Statistics (Paris 21- 2007), and the Wye Handbook on Rural Households Livelihood and Well-Being ((2007).*

15. The *Global Strategy* is also based on extensive consultations with national statistical offices, ministries of agriculture and other national institutes plus all international statistical organizations that have a stake in improving agricultural statistics. Considerable input was provided by the UN Statistical Commission Friends of Chair Working Group, the 2009 meetings of the International Statistical Institute meetings in Maputo, and Durban, FAO conferences of regional commissions on Agricultural Statistics, and a World Bank peer review. A Wikipedia web page (wiki.asfoc.ibge.gov.br has also been established to enable stakeholders to provide input. The *Global Strategy* takes into consideration the different stages of statistical development across countries; but also technical developments that can contribute to the improvement of statistics. Therefore, the *Global Strategy* should be considered to be a long range plan requiring an examination of governance at the national levels, the establishment of statistical capacity building across the national statistical system, and the restoration of resources to carry it forward. The *Global Strategy* continues with the following chapters.

- **Chapter 2. A Conceptual Framework for the Collection of Agricultural Statistics.** A conceptual framework based on a thorough assessment of users' data needs was developed. It pointed to many emerging requirements from issues closely linked to agriculture such as poverty and hunger, the environment and climate change, the use of land and water, and the increasing use of food/feed commodities to produce bio-fuels. Based on these requirements, the conceptual framework broadens the scope and coverage of agricultural statistics to include aspects of fisheries, forestry, and rural households and provides a menu of indicators. The conceptual framework translates policy issues into statistical language by identifying the need for the survey framework to provide the linkage between the farm as an economic unit, the household as a social unit, and the land they occupy in the natural environment. The Conceptual Framework suggests that the fundamentals of the *Global Strategies* be based upon three pillars: Identifying a minimum set of Core data; the integration of agriculture into the national statistical system; and the sustainability of the agricultural statistical system through governance and statistical capacity building.

- **Chapter 3. The First Pillar-Identifying a Minimum Set of Core Data and Determining National Priorities.** The data requirements identified in the conceptual framework exceed what any country can provide for the same point in time. Therefore a minimum set of core data is identified to be used as a starting point upon which to develop the *Global Strategy.* This core set of data will provide national and international policy makers necessary information that goes across national boundaries. The *Global Strategy* provides a framework for countries to add items of national interest to the set of core data and determine the frequency they will be provided. The set of core data provides the beginning point for the improvement of agricultural and rural statistics.

- **Chapter 4. The Second Pillar-The Integration of Agriculture into the National Statistical System.** The overlapping data requirements and the recognized need to improve the underlying statistics and methodology point directly to the integration of agriculture into the national statistical system. The integration enables the concentration of resources from different sources, removes the duplication of efforts to produce statistics, and provides the blue print for the inclusion of agriculture in the National Strategies for the Development of Statistics (NSDS) as described by Paris 21 (2004). The *Global Strategy* provides the framework to achieve the integration based on the development of a master frame for agriculture, its use in an integrated survey system, and the implementation of a data management system.

- **Chapter 5. The Third Pillar-The Sustainability of Agricultural Statistics by Governance and Statistical Capacity Building** The conceptual framework leading to the integration of agriculture into the national statistical system points to requirements for governance bringing together the efforts of the different stakeholders; especially the national statistical institutes and ministries of agriculture. While the *Global Strategy* provides the framework for integration, it leaves the implementation to each country to decide and suggests they do so by the formation of a national statistics council. Other issues addressed are the steps to implement the strategy including the inclusion of the fundamentals of the *Global Strategy* in the National Strategies for the Development of Statistics.

- **Chapter 6.** The *Global Strategy* concludes with **Challenges remaining and the Way Forward.** The challenges remaining include defining the several dimensions of data quality and methodological problems that need to be addressed. The implementation plan spells out the respective roles of national and international organizations for fund raising, statistical capacity building, and the promotion of regional centres of excellence to support and provide training on the use of methodology as remote sensing for agricultural statistics The implementation plan also considers the roles of donors and data users in the implementation of the *Global Strategy.*

16. Annex A provides a menu of indicators, data sources, and technical notes. The core indicators provided in the *Sourcebook* (2008)and the emerging requirements described in the FAO evaluations were the starting points. The menu of indicators also includes those needed to understand the issues surrounding the environment, climate change, and the introduction of biofuels. Because countries have varied and limited capabilities, it will be necessary for each country to establish priorities for the collection of the basic data in addition to a core set that are universally needed and are comparable across countries. Annex B provides an overview of sample frames used for agricultural statistics.

Chapter 2: A Conceptual Framework for the Collection of Agricultural Statistics

17. Statistics on agricultural and rural development are used by policy makers, private decision makers, and donors to inform their decision making as they address a variety of important issues. It is these priority issues that drive the choice of indicators to be developed and the core data to be collected.

18. Various attempts have been made to quantify the value of information to public and private decision makers. Foregoing the net benefits of providing decision makers with the information is equivalent to the cost of *not* having the information. In the cases considered in the literature, the benefits of the information far outweighed the costs of providing the information. For example, *Gardner (2004*) has reviewed some of the literature which quantifies the value of agricultural market information to private decision makers and the value of information to public decision makers regarding domestic U.S. policy reform, trade policy reforms, and investments in public R&D. In the same volume, *Norton and Alwang (2004)* consider case studies on the value of information regarding deforestation in the Amazon and pesticide use in the Philippines. Both reviews found high net benefits to providing decision makers the information.

19. Many of today's critical issues are not new, but have increased in their importance, are framed differently, or have been newly recognized. Consequently, many of the traditional indicators in use remain relevant while others need to be refocused or newly developed. The independent review of the FAO statistics program included an effort to seek input on emerging data needs from major users and partners. One overall finding of the report was that there was a great deal of overlap in the issues identified among the stakeholders contacted, including national statistical centers, major users, Non governments donor organizations, and research institutions. Indicators and emerging issues included: prices, energy/biofuels, the agro-environment, climate change, trade, subnational data, water, land/soil, household consumption, food security, socio-economic data, economic accounts, management of natural disasters, and fisheries. The report also indicated that stakeholders had high expectations for geo-spatial and remote sensing data and expressed the need for improved integration, access, and searchability of data bases.

20. The most critical issues are not independent of each other, and much of the data are needed for more than one indicator. The goal of the *Global Strategy* is to capture the interrelationships of these emerging issues and ensure appropriate indicators are defined and underlying data provided. This points to a major problem with current agricultural and rural statistics; many of the issues have been considered independently which does not allow the cross-cutting analysis that is most desperately needed.

Dimensions of data demand

21. While agriculture is fundamentally an economic activity (the core of agriculture is the production of food and other commodities), there is an increasing awareness and concern about its relationship with environmental and social issues.

22. These three dimensions need to consider the broad context in which agriculture takes place which is the institutional framework of government and enterprises that affect all three via policies, regulations, taxes, and infrastructure such as transportation, education, markets, processing facilities, etc. It should be recognized that the institutional framework exists at the local, national and international levels. The international level deserves consideration because of the globalization of markets, and international attempts to fight poverty and control global warming, to name a few. Enterprises include those not directly engaged in agricultural production, but provide services such as cotton ginning, processing of meat, milk, etc.

23. The economic dimension includes the land, labor, and capital that enter into the production process and the resulting outputs. The output of the production process takes many forms; some are consumed by the household, retained for seed or feed to be used on the agricultural holding, or enter the marketing channel. Some of the products require processing such as crushing soybeans for oil, ginning cotton, or the slaughter of livestock by non agricultural enterprises. An emerging output is the use of agricultural commodities for the production of energy products. The outcome of the production process is income to the agricultural and non agricultural enterprises, and to households—both agricultural and non agricultural. The impact of the production process affects food security, poverty, and the sustainability of the environment and the economy.

24. The environmental dimension recognizes that agriculture is a significant user of environmental resources—in particular, land and water -- and a provider of environmental services. This includes both the direct use of environmental resources in production, and the use of these resources as sinks through waste and emissions. In addition to its use of environmental resources, agriculture can alter the condition of those assets which has implications for climate change and bio diversity. These issues lead to concerns about the impact of economic activities of agriculture upon the global and local environment and point to the need for statistics that permit analysis of the interaction between the environment and the economy.

25. The social dimension of agriculture starts with households that have agricultural holdings. The households of agricultural holdings include the agricultural holder and other members working on their own account or as employees. Agricultural households may earn income

from non-agricultural activities and are users of health, education, and other social programs.

26. There are also non agricultural households that may not be directly engaged in agriculture but whose well-being is interdependent with agriculture and agricultural households. These households are typically located in rural communities; however, these communities are more than a spatial clustering of households in sparsely populated areas. A multitude of interactions and interdependencies of businesses, households, and governments exist within rural communities connecting the community population to each other and to surrounding territories. Rural development is a dynamic process of change in a territorial framework, and agriculture is one sector within this multi-sector territorial framework. These linkages between agriculture and community place certain aspects of rural communities within the scope of the social dimension of agriculture.

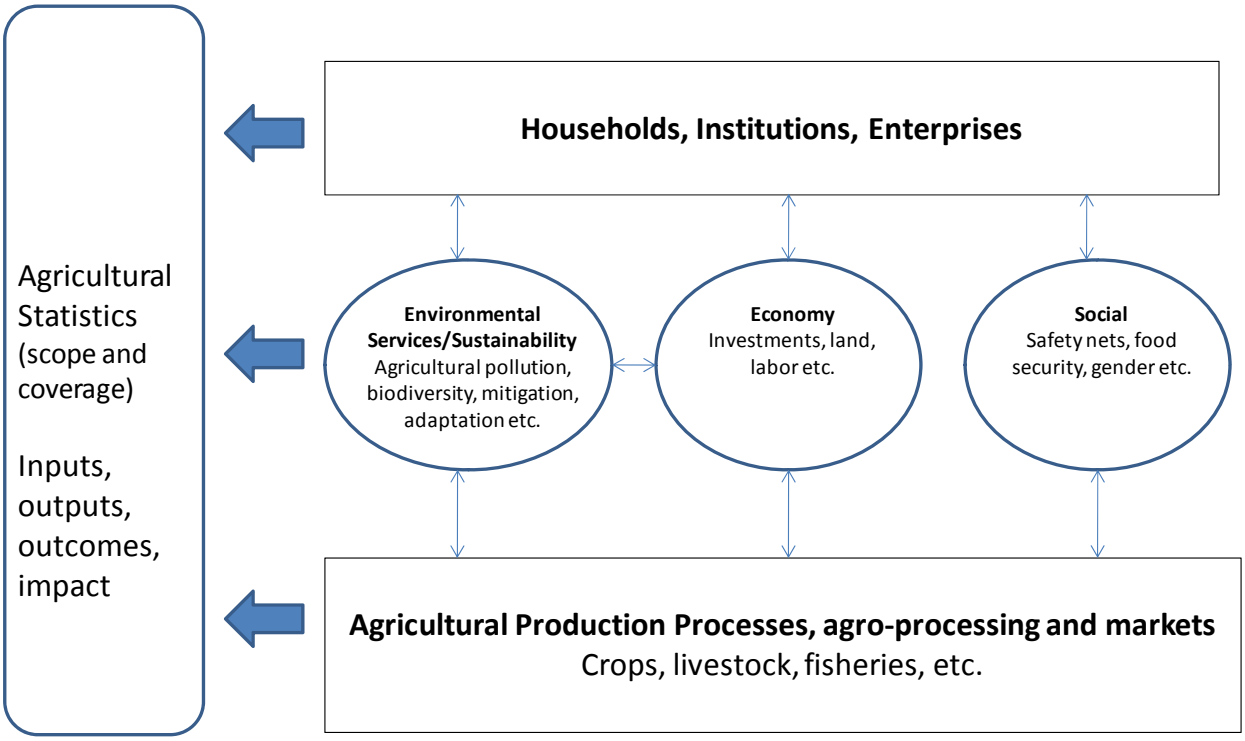
27. The output of the agricultural process affects the income of both agricultural and non agricultural households. Policy decisions that affect the choices made about different patterns of production have implications about the well-being of the households. Policy makers setting environmental standards can cause consequences about the economy, again affecting the household income.

28. These three interconnected dimensions combined with desired high priority outcomes provide a map of data demand.

The conceptual framework

29. The conceptual framework (see Figure 1) brings together the economic, environmental, and social dimensions of agriculture, and recognizes that there is a cause and effect relationship between them which is also related to the overall institutional framework under which it functions. In turn, they relate to agricultural production, processing and markets as well as income allocation and distribution, accumulation, and consumption At each of these levels agricultural statistics are needed at the input, output, outcome and impact stages.

Figure 2: The Conceptual Framework for Agricultural Statistics



The economic dimension

30. The economic dimension covers agricultural production, markets and, farm and non-farm income.

31. **Agricultural production**. Data on agricultural productivity is important to decision and policy makers. Productivity is rising when additional output is produced for the same level of inputs, or alternatively, the same amount of output is produced with fewer inputs. Therefore, the starting points for measuring changes in agricultural productivity are data on the quantity and prices for outputs and inputs. Other inputs into production are capital inputs that are consumed over multiple years of production. Information is required on the capital stock to determine the depreciation of these items over time and for use in developing a balance sheet.

32. Although agricultural productivity growth has been a long-term concern, the new emphasis on agricultural growth is the explicit monitoring and evaluation of its role in reducing

poverty and hunger. According to the 2008 *World Development Report*, GDP growth originating in agriculture is at least twice as effective in reducing poverty as GDP growth originating outside agriculture. Consequently, the importance of public and private donor investment in agriculture and rural areas to attain specific outcomes is more closely monitored. Investors, public and private, have an important role to play in fostering agricultural productivity growth through investments in infrastructure, new technology, and physical and human capital.

33. Fish and other aquatic organisms are major sources of food and household income. This domain includes the capture of fish in the open sea shared by all countries, captures in the coastal zones managed by each country, captures from rivers and other fresh water sources, and finally aquaculture which involves the use of land, inland and coastal waters, and the culture of fish. Countries are responsible for the provision of statistics on all fisheries and aquaculture within their own national jurisdiction areas including their exclusive economic zone as well as conducted by vessels which fly their flags.

34. Regional Fishery Bodies have been formed to coordinate the data collection and management of fishery resources and fisheries of open access including high seas areas and species. Data collected by Regional Fishery Bodies generally contain more detailed information on operational and biological aspects of capture fisheries.

35. Small scale and subsistence aquaculture and capture fisheries often provide the opportunity of last resort for earning and food security for people without access to land. Also, small households tend to involve multiple activities, e.g. combination of subsistence aquaculture in conjunction with agriculture. Increased competition between aquaculture and agriculture for water and land use is emerging, especially as one of climate change impacts.

36. **Markets**. Effective marketing systems depend upon information on supply and demand and market prices freely available to all participants in the marketing system. The marketing system should be considered in the broader sense to include markets for inputs and those involved at every stage of the modern supply chain from production to final delivery to the consumer. (These indicators are also required to measure agricultural productivity.)

37. **Increasing farm and rural non-farm income**. A basic indicator of the performance of these sectors is a measure of net farm income or gross domestic product (GDP) from agriculture. Tracking this indicator for policy purposes provides an understanding of the conditions facing producers—as a group--and whether or not they are likely to have adequate resources for the next production cycle. One of the ways that national accounts are utilized is to examine how value added is distributed to the factors of production: land, labor, capital, and the entrepreneurship of management. Current levels of aggregate indicators are useful in the context of previous or forecasted levels to provide a gross indicator of how the economy is faring compared to the past situation or expectations for the current period.

38. While informative about structure and organization of a country's agriculture, GDP in agriculture provides little information about the well-being of different types of producers

and households. Many households engage in nonfarm work activities and sometimes more than one household shares the returns of a farm holding. These complex resource allocations within and among households, along with the uneven distribution of income, means average GDP income is not a useful indicator of the well-being of people. As the *Source Book (2008)* points out, the ultimate goal of nearly all development projects is to reduce the level of poverty and monitoring progress towards that goal requires the use of a household survey (p. 30). A household survey to collect data on agriculture is very resource intensive is often not practical for many developing countries, although some successful attemts have recently been made through the Living Standards Measurement Survey-Integrated Surveys on Agriculture (LSMS-ISA).[3] The *Source book* offers alternatives to household surveys, including steps to determine the answer to the question, "are the services actually reaching the poor and vulnerable" In a Service Delivery Survey.

The social dimension

39. The social dimension covers the need to reduce risk and vulnerability including food security, and issues related to gender.

40. **Reducing risk and vulnerability**. National leaders and private decision makers in the marketplace will be better able to manage risk and vulnerability with forecasted information about risky situations. Natural disasters, such as storms and droughts, and other market place disruptions can cause serious disruptions in food supplies and also distort prices.

41. **Food security** is an essential requirement of any country. Assessing food security at the national level involves information on commodity production, using many of the indicators necessary for measuring productivity and enhancing the efficiency of markets. In addition, food security includes consideration of food trade and non-food use (fuel, drug industry, seed, feed, etc). Information is also required on consumption by agricultural and non-agricultural households. The information collected in household surveys on food demand involves all households in the country, i.e, urban and rural (agricultural and non-agricultural). Food security also requires information to assess the food gap in terms of nutrients.

42. **Gender**. In many countries, family roles, responsibilities, and rights are gender-related and extend beyond biological differences. For this reason, the MDG to "promote gender equality and empower women" is seen as directly linked to progress in agriculture. Research has shown the importance of considering the gender of farm people in efforts to understand and affect their behavior and improve the conditions of those in extreme poverty and hunger. In some countries, equalizing resources and strengthening women's property rights have been shown to raise yields and increase incentives to adopt agroforestry and improve environmental management, as well as to have a positive effect on education, health, and nutrition of the family.

The environmental dimension

43. The environmental dimension covers issues of sustainability and the provision of environmental services by agriculture.

44. **Climate change and other agro-environmental issues.** In most countries, agriculture is the largest user of water, the cause of agro-chemical pollution and soil degradation, and a contributor to climate change. Fisheries, in fact, directly utilizes and impacts on national resources and environments. Agriculture's environmental footprint also involves the management of animal waste and the spread of animal diseases. However, agriculture plays a positive role in sequestering carbon, managing watersheds, preserving biodiversity, and providing feed stock for biofuel production. Information on many of the production inputs that are used in measuring productivity is agro-environmental, but it must be available in a disaggregated form.

45. **Food and Feed products for Biofuels.** The goal to reduce carbon emissions from burning fossil fuels could be met partially from the increased use of food and feed stock to produce biofuels. While this can significantly increase prices and income for the producers, it can raise food prices to a level forcing people back into poverty. The use of biomass to produce fuel has resulted in intensive efforts to use nonfood crops instead of food crops for fuel production. One example is switchgrass being developed for use on marginal, highly erodible lands. It also requires less energy than food crops in the conversion from biomass to fuel. Another example is Jatropha which is a small tree producing seeds that when crushed produce oil that can be used for making biodiesel. The crop is being grown in South America, Africa, and Asia and is resistant to drought and pests. The potential for these commodities could have economic consequences if they replace traditional crops and their established infrastructures for inputs and marketing. Output quantities and input prices relevant to biofuel issues are also relevant to the measurement of productivity, but they must be available in a disaggregated form, i.e., for commodities used for biofuel purposes relative to other purposes.

46. **Land Cover and Use, including Forestry**. Land is the foundation of agriculture and forestry. How the land is used determines its sustainability and productivity. The use of land can also have environmental consequences that range from pollution of waterways to global warming. Land cover is defined as "the observed physical cover including the vegetation (natural or planted) and human constructions that cover the earth's surface" (FAO 2005). Agricultural expansion is a principal factor contributing to deforestation which results in increasing levels of carbon dioxide in the atmosphere. Forests and woodlands absorb carbon dioxide (a major cause of global warming) from the atmosphere, thus mitigates the effect of carbon emissions from burning fossil fuels. It is necessary to monitor land cover over time to reveal changes resulting from deforestation, urbanization, desertification, and other measures related to not only agricultural productivity but the overall affect on the environment and global warming.

47. The System of Integrated Environmental and Economic Accounting (SEEA) uses two land classification systems. The Land Cover Classification System[4] classification manual (LCSS) jointly prepared by the FAO, the United Nations Environment Programme (UNEP), and Cooperazione, Italiana (2005) provides an international classification standard describing land cover as characterized by the arrangements, activities, and inputs people undertake in a certain land cover type to produce, change or maintain it. This establishes a direct link between land cover and the actions of people in their environment. For example, "grassland" is a land cover, rangeland implies its use to support livestock, thus is a land use. The other classification is contributed by the FAO based on global statistical data bases of agricultural and forestry land use structures .

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48. **Water use.** Like land, water is a critical integrating variable that is cross cutting with agriculture, forestry, and fisheries which in combination affect the environment, climate change, and food security. Water for irrigation is a major factor to improve land productivity and crop yields. According to AQUASTAT, FAO's global information system on water and agriculture, agriculture uses 70 percent of freshwater withdrawals globally and 85 percent in developing countries. Demand for water is increasing for both agricultural and non agricultural uses. In some countries, this is leading to unsustainable extractions of ground water. There is a lack of data concerning water use for agriculture, the distribution of irrigated land, and water use practices including aquaculture.

Agricultural statistics: scope and coverage

49. **Scope.** The starting point to determine the scope of agricultural statistics is the system of national accounts (SNA) which provides international standards for concepts, definitions, and classifications of economic activities. The conceptual framework also points to the need for a system of environmental accounts that describes the affect of agriculture on the environmental dimension. The System of Integrated Environmental-Economic Accounting (SEEA)—which is a satellite account of the SNA—should be the starting point for the environmental statistics. While there is a framework for household decision making, there is no equivalent internationally accepted standard for social statistics. The guiding principle will be to follow the social-economic aspects captured within the national accounts.

50. The International Standard Industrial Classification of Economic Activities (ISIC) provides the classification of enterprises to industries. The scope of agricultural production as defined b**y** this classification includes group 011(growing of crops, market gardening, and horticulture), 012 (farming of animals), and 013 (growing of crops combined with farming of livestock). The Food and Agricultural Organization (FAO) uses this classification as the basis to determine the scope of the agricultural census as described in The World Program for the Census of Agriculture-2010 (FAO 2005). Another important international standard

classification is the Central Product Classification (CPC). In its new revision, CPC v.2.0, substantial improvements have been made especially for the areas of agriculture, fisheries, forestry, and food. Items such as crops, livestock, machinery and equipment, and fertilizers and pesticides as listed in the World Programme for the Census of Agriculture 2010 are all well classified in CPC v.2.0. Both ISIC and CPC provide important tools for integrating agricultural statistics into national statistical system.

51. Agro forestry and aquaculture are considered to be agricultural activities because they involve purposely growing trees or fish following agricultural practices and require the use of land and water. Other forestry and fishery activities are generally outside the scope of the agricultural census except when they are activities carried out in association with the production activities of the agricultural holding. These areas in many countries compete with agriculture for land and water; policy decisions about land and water use have both economic and environmental consequences.

52. The following paragraphs outline the broadened scope of agricultural statistics based on the conceptual framework. This broadened scope will include aspects of forestry, fisheries, and land and water use as required to meet the merging and inter-related economic, social, and environmental issues faced by policy makers.

53. Because of the inherent and fundamental relationship between agriculture and land, the geo spatial aspects of land should be seen as an element of the scope of agricultural statistics. The geo spatial scope for agricultural statistics should focus on the use of land for agriculture and forestry and take place within a broader scope of national land use statistics.

54. Forestry has two aspects. One is its relationship with agriculture as a land use with environmental impact; the other is the production of forestry products. The required data for forestry and woodland outside that described above as related to agriculture will be the responsibility of the conventional sources which from a governance standpoint will become part of the national statistical system for coordination purposes.

55. An important component of the food supply affecting food security and household income comes from aquaculture and the capture of fish. Aquaculture is defined by the FAO (World Programme for the Census of Agriculture) as the farming of aquatic organisms such as fish, crustaceans, mollusks, aquatic plants and other aquatic organisms. This implies the feeding, regular stocking, protection from predators, and raising of organisms through one or more life cycles. All aquaculture and capture production, employment, and food security information will be in the scope of agricultural statistics. This does not mean the national statistical office undertakes the data collection if it is the responsibility of another governmental body. However, the responsibility for oversight should be placed under the governance of the national statistical system with the provision of linkage and the use of common standards, definitions and classifications and utilizing common or inter-operable data bases.

56. The scope of agricultural statistics will include uses of water for agricultural purposes including irrigation and other uses, the source of irrigation water, the land under irrigation, the irrigation method, and the resulting production. This will be done in collaboration with the FAO-AQUASTAT Programme, the global information system on water and agriculture.

57. The intersection of the connections between the dimensions of the conceptual framework points to the need for data described in systems of accounts such as supply utilization accounts, food balances, and income accounts for the household and agricultural enterprises. These accounts require data from many sources including the government, households, agricultural holdings, and agricultural businesses. The following paragraphs define the coverage and statistical units to be included in the scope of agricultural statistics.

58. **Coverage.** The FAO's World Program for the Census of Agriculture recommends that the 2010 round of the census consider the agricultural holding as the statistical unit. However, the same report provides guidelines about the use of a population census and the collection of agricultural data for households that are not agricultural producers. The use of the population census to obtain basic information about agricultural and rural households provides the vehicle to broaden the scope of the coverage required to meet the emerging data requirements under the conceptual framework. *The World Program for the Census of Agriculture and the Source Book* also consider the rural community as a statistical unit for components of the social dimension.

59. The statistical unit is dependent on the dimension. The statistical unit for economic statistics should be the agricultural holding. The statistical unit should be the household for social statistics and the land parcel for environmental statistics. The challenge will be to provide a linkage between these statistical units. In many cases, there will be one-to-one relationships between the agricultural holding, the household, and the land parcel. In these cases, it will be feasible to collect economic, social, and environmental information from one unit. If these units are geo-referenced, then the three dimensions can also be associated with the overall land use.

60. In some cases, there will not be a one-to-one correspondence between the agricultural holding and the household. However, a goal should be to statistically establish the linkages between the economic, environmental, and social dimensions as described in the conceptual framework. Chapter 4 will provide the necessary strategy to achieve these linkages via an integrated statistical system.

61. Rural households as statistical units will be within the scope of agricultural statistics. Agricultural development provides a pathway out of poverty and hunger for the rural poor. These pathways can include improving the income of small agricultural holders through wage employment in agriculture or the rural non farm economy, or by migration. The need for statistics for rural development led to the production of *The Handbook on Rural*

Households Livelihood and Well-Being. The necessary data underlying many of the indicators needed to monitor rural development, and economic growth leading to poverty and hunger reduction are based on the rural household as a statistical unit.

62. Other statistical units required by the global strategy are enterprises in the sectors servicing agriculture such as suppliers of fertilizer, processors, and transporters of agricultural goods. While these economic units are outside the conceptual framework for agriculture, they are providers of information needed in the economic and environmental accounts such as prices and quantities processed, for example. Local communities are important sources of information about social services provided to agriculture holders and rural households.

63. All activities within the scope of agricultural statistics should be covered without any cut-offs based on size, importance, location, etc.

64. Many countries use minimum size criteria holdings must meet before they are included in a census or survey. Many countries may also concentrate their efforts on major producing areas and not provide estimates for the entire country. The minimum size criteria differ depending on the country and vary from the area of the holding, number of livestock to commodity sales. The minimum size criteria are used for cost effectiveness purposes. However, the reality is that in many countries, the small scale or household plots make a significant contribution to household food supplies or a source of extra income. Small holdings are often the responsibility of women.

65. For the purposes of the strategy, all units regardless of size and location regarding agriculture should be included in the scope of agricultural statistics. This would be made possible by the inclusion of some basic questions about agriculture in the population census. The inclusion of the small and geographically isolated household holdings in the annual statistical program will be considered in the methodology chapters. The minimum size criteria and geographic coverage should be inclusive for the population and agricultural censuses, but can be different for the annual survey program.

66. There are special problems facing the agricultural statistician, especially in measuring and documenting the impact of both the local environment and seasons on agricultural activities. Agriculture differs from most if not all other productive sectors of the economy in the impact that location and the time of the year have on the production process. Even in technically advanced countries, the production process is directly related to the location it takes place and the time of the year that activities are carried out. In developing countries this relationship is even stronger as is the impact of events outside the farmer's control, especially the impact of weather patterns. In order to collect data that provides an accurate picture of the activities of the agricultural sector, therefore, statisticians need to provide statistics that take into account seasonal variation and the heterogeneity of production patterns.

67. The data requirements and the conceptual framework of agriculture have been described. The next chapter builds off the conceptual framework and the data requirements presented in previous chapters and provide a framework to establish a minimum set of core data that can be used to derive many of the required indicators.

Chapter 3: the First Pillar – Identifying a Minimum set of Core Data and Determining National Priorities

68. The purpose of this chapter is to define a minimum set of internationally comparable core data countries should provide for the estimation of the indicators provided in Annex A. A minimum set is identified because the amount of data required to meet all user requirements exceeds what most countries can provide before rebuilding their statistical system. This chapter will provide the framework to select a minimum core set of data, determine the frequency they should be provided, and the extent of the national coverage. A framework will be provided for countries to add to this core set those items also required for their national statistical program, the frequency they will be provided and the scope of the national coverage. The core and national items and associated data will be used as a starting point to implement the Global Strategy as defined in Chapter 4.

Box 1. Indicators, variables and data items

A food production index is an indicator.

Maize is a data item that enters into the index

Variables about maize include area harvested, yield, production, utilization, prices, etc.

69. A review of the indicators in annex A shows that a major input to many of them is basic statistics on the production of crops, livestock, aquaculture, fish captures, and the timber removals from forests. The *World Program for the Census of Agriculture* lists 149 crops, 28 livestock species, and about 1400 fishery and aquaculture species. Not all are produced in every country, nor are they of equal importance where they are produced. Data on inputs, production, and prices for all of those several hundred items are needed for indicators such as GDP growth from agriculture value added and several others as well. The FAO sends annual questionnaires to countries requesting data on production, trade, land use, agricultural machinery and equipment, fertilizer, and pesticides. Producer price data are also requested. The problem is that these annual requests cover the population shown above for the World Program for the Census of Agriculture. These data requirements exceed what any country can produce on an annual basis. Therefore, the first step is to select a minimum subset that countries will provide using definitions and methodology so that the measures are internationally comparable. The goal is to determine the minimum subset of items for which data will be provided annually and a framework to establish the frequency for which the remaining data will be furnished.

70. The following paragraphs describe the process to arrive at an internationally agreed upon set of core data items each country will provide. Because countries have varied and limited capabilities, it will be necessary each one establishes priorities on what will be included in their national statistical system in addition to the core set.

71. A core data item should be a major contributor to global supplies of agricultural production. For example, only about 10 crops and 4 livestock species account for over 95 percent of the world's production of cereals, meat, and fiber. A core data item is one whose data enter into a multitude of indicators needed to monitor and evaluate development policies, food security, and progress toward meeting the MDG goals. Core data should provide input to the national accounts and global balances of supply and demand for food and other agricultural products. A core item should be a major user of land if it is a crop, contribute significantly to farm and rural household well-being, and one that has an effect on the environment and climate change. A core item should be one that is the first to be included in the statistical system and the last to remove with budget shortfalls.

72. Core items and their related data are required by the global statistical system to monitor issues that go beyond national boundaries. The globalization of the world's economies means that an action in one part of the world affects food supplies, the environment, and climate in other areas.

73. The list of core items and associated data should establish the framework for the agricultural and rural components of the National Strategies for the Develop of Statistics (NSDS) when they are being implemented. The set of core data items will be the building block to establish methodology and to integrate agriculture and rural statistics into the national system.

74. The designation of core starts with basic production statistics for the major crop items, livestock, aquaculture, fishery products, and timber removals. The following paragraphs provide the core items. The presentation of the core items will be followed by the framework for countries to add their additional national requirements to the core list and to also determine the frequency for which both core and national data will be provided.

Set of Core Items and Associated Data

75. The **core crop** items are wheat, maize, barley, sorghum, rice, sugar cane, soybeans and cotton. These crops are a major land use, the main contributors to food supplies, and value added from agriculture. The production can vary considerably from year to year. The production can be used for a variety of purposes ranging from food to bio-energy which has implications about food security and also on the environment depending on policy decisions to meet the demand for both. Data required for these core items include:

a. Area planted and harvested, yield, and production.

b. Area of cropland that is irrigated

c. Producer and consumer prices

d. Amounts utilized for own consumption, food, feed, seed, fiber, oil for food, bio energy, and net trade or imports and exports.

e. Early warning indications such as precipitation, windshield surveys of crop conditions, and vegetative indices provided by satellite observations.

76. The **core livestock** items include cattle, sheep, pigs, goats, and poultry. These are the major contributors to food supply and income to agriculture. Consumption increases as countries develop therefore, requiring more livestock consuming grain and adding to methane emissions; all which can be affected by policy decisions. Data required for these livestock items include:

a. Inventory and annual births

b. Production of products such as meat, milk, eggs, and wool, and net trade or imports and exports.

c. Producer and consumer prices

77. **Core Aquaculture and fisheries products** significantly contribute to food supplies, and in the case of aquaculture use land and water. Fisheries provide livelihood for small scale and inland holdings. Data required include:

a. Area cultured, production, prices, and net trade or imports and exports for aquaculture.

b. Quantity landed and discarded, number of days fished, amounts processed for food and non-food uses, prices, and imports and exports.

78. **Core Forestry production** is a major land use, provides income, and has a significant role in understanding the forces affecting climate change. Data required include:

a. Area in woodlands and forests, removals, and prices for land associated with agricultural holdings.

b. Area in woodlands and forests, removals, and prices for products from non agricultural holdings and respective utilizations.

79. **Core Inputs to agricultural production** include labor, chemicals, water, energy, and capital stocks. Inputs are considered core because they in combination with data about outputs provide measures of agricultural productivity important to monitoring and evaluating steps to reduce poverty and hunger. Data required include:

a. Quantities of fertilizer and pesticides utilized.
b. Water and energy consumed
c. Capital stocks such as machinery by purpose, i.e. tillage or harvesting
d. Number of people of working age by sex
e. Number workers hired by agricultural holders
f. Employment of household members on the agricultural holding.

80. Core socio-economic characteristics of **Agricultural and rural households includes** Household income by source as a key measure of the economic well-being of rural households to guide policy decisions about developmental efforts to reduce poverty. Periodic data about the number of households, household income, housing conditions, employment, population, age, gender, and education levels are also required. See table 1 for more details.

81. **Land cover is a core item.** A fundamental way to evaluate agriculture's affect on the environment is to monitor changes in land cover and use. Land cover does not change rapidly; therefore, the data are not required annually. However, mapping products or digitized data from remote sensing should provide complete coverage for the entire land mass of a country with the following classifications:

a. Cropland
b. Forest land
c. Grassland
d. Wetlands
e. Settlements
f. Other Land
g. Water

82. **Public expenditures on subsidies, infrastructure, and health and education in rural areas are core items.** This should include the availability of roads, transport services, communications, and extension services.

Table 1 below shows the core data items grouped by key variables in the economic, social, and environmental dimensions. Note that the basic production data items are required annually. The strategy to establish the frequency of the remaining core data items is described in the next section that describes the steps to determine the national priorities. The frequency requirement is also considered in the design of the integrated survey framework presented in Chapter 4.

Table 1 Minimum set of core data

Group of Variables	Key Variables	Core data items	Frequency
Economic			
- Output	Production	Core crops (e.g wheat, rice, etc.) Core livestock (e.g. cattle, sheep, pigs, etc.) Core forestry products Core fishery and aquaculture products	Annual
	Area harvested and planted	Core crops (e.g wheat, rice, etc.)	Annual
	Yield / Productivity	Core crops, core livestock, core forestry, core fishery	Annual
- Trade	Exports in quantity and value	Core crops, core livestock, core forestry, core fishery	Annual
	imports in quantity and value	Core crops, core livestock, core forestry, core fishery	Annual
- Stock of Resources	Land cover and use	Land area	[3]
	Economically active population	Number of people in working age by sex	
	Livestock	Number of live animals	
	Machinery	e.g. Number of Tractors, harvesters, seeders etc.	
- Inputs	Water	Quantity of water withdrawn for agricultural irrigation	
	Fertilizers in quantity and value	Core Fertilizers by core crops	
	Pesticides in quantity and value	Core Pesticides (e.g. fungicides herbicides, insecticides, disinfectants) by core crops	
	Seeds in quantity and value	by core crops	
	Feed in quantity and value	by core crops	
Agro processing	Volume of core crops/livestock/fishery used in processing food	By industry	
	Value of output of processed food	By industry	

[3] The frequency for the following items will be established by the framework provided in the Global Strategy to determine the national priorities for content, scope, and frequency. The frequency requirement will also be considered in the establishment of the integrated survey framework where the data sources will be defined.

Group of Variables	Key Variables	Core data items	Frequency
	Other uses (e.g. biofuels)		
Prices	Producer prices	Core crops, core livestock, core forestry, core fishery	
	Consumer prices	Core crops, core livestock, core forestry, core fishery	
Final expenditure	Government expenditure on agriculture and rural development	Public investments, Subsidies, etc.	
	Private Investments	Investment in machinery, in research and development, in infrastructure	
	Household consumption	Consumption of core crops/livestock/etc. in quantity and value	
Rural Infrastructure (Capital stock)	Irrigation/roads/railways/ communications	Area equipped for Irrigation / Roads in Km / Railways in Km / communications	
International transfer	ODA[4] for agriculture and rural development		
Social			
Demographics of urban and rural population	Sex		
	Age in completed years	By sex	
	Country of birth	By sex	
	Highest level of education completed	1 digit ISCED by sex	
	Labor status	Employed, unemployed, inactive by sex	
	Status in employment	Self Employment and employee by sex	
	Economic sector in employment	International Standard Industrial Classification by sex	
	Occupation in employment	International Standard Classification of Occupations by sex	
	Total income of the household		
	Household composition	By sex	
	Number of family/hired workers on the holding	By sex	
	Housing conditions	Type of building, building character, main material, etc.	
Environmental			
Land	Soil degradation	Variables will be based on above core items on land cover and use, water use, and other inputs to production.	
Water	Pollution due to agriculture		
Air	Emissions due to agriculture		

[4] Official Development Assistance

Group of Variables	Key Variables	Core data items	Frequency
Geographic location			
GIS coordinates	location of the statistical unit	Parcel, Province, Region, Country	
Degree of urbanization	Urban/Rural area		

Determining National Priorities-content-scope-and frequency

83. Data for some core items will not be required every year because they either do not change much from year to year or are difficult and expensive to obtain annually. Countries will also have additional items to add to the list of core to meet national data needs. Teff in Ethiopia is an example; it is a major source of food there, but with little production in other countries. Other items such as rice are major food sources, but are not produced in every country.

84. Therefore, the next step is for each country to establish the set of core items they will include in their national system, add other items relevant to their economy, determine the frequency data will be provided, and the scope of the national coverage. For example, the core data do not include fruits and vegetables, nor other livestock items that contribute to a country's food supplies and household income. Each country should consider how these should be included in the national system.

85. The goal should be to provide annual data for those items that combined account for over three fourths of the country's value of production and coverage of land, production s that can vary significantly from year to year, impact the majority of the households, and have short term affects on land use and the environment. The inclusion of items that are produced by only a small number of households or holdings or account for only a small share of the nation's land has sample design and resource implications. For example, sampling theory shows that the relative variance of the estimated mean is approximated by the relative variance of the positive sample units plus the relative variance of the estimated proportion of positive population units.

$$CV^2(Y) = CV^2(Y_p) + CV^2(P)$$ where Y_p is the mean of the positive responses and P is the proportion of the population that has the item

86. Suppose only a third of the households or holdings have a particular item. The sample size will have to be 4 times larger than if about three fourths have the item to achieve the same level of precision. If only 10 percent of the households or holdings have the item, then sample sizes triple over what is needed if a third are positive and would be 12 times greater than if (P) > .75 for the same level of precision. The general conclusion of this exercise is that minor and relatively rare commodities should be candidates to only be included in the

agricultural census. The exception would be if the sample frame contains sufficient data that can be used in the survey design to target the rare items.

87. The next step is to review the rural development data requirements for monitoring and development in the *Source Book (2008)* and include those relevant to the national situation. Then each country should determine the level of geographic coverage and detail to be provided for the core plus additional items added. The same issue raised above about the proportion of households/holdings that have the item will also determine the level of geographic detail or other breakdown that can be provided from the sample surveys. These have implications about the methodology to be used and resources required. The annual data collections will rely upon sample surveys which will limit the geographic detail that can be provided. Therefore, it may be only through an agricultural census that detailed geographic or size distribution data can be provided.

88. The final step to the process is to list the core and other items to be included in the national statistical system for agriculture, determine the desired level of detail, and indicate for each item the frequency that data will be provided. Table 2 provides an example showing a decision matrix for the scope of the national coverage and frequency of collection. For example, it should be determined for each item whether the data will be provided for the entire country or only major producing areas. It is generally true that policy makers will want data for within country administrative areas such as provinces; if so, this should be included in the national framework. Household plots are major contributors to food supplies in some countries; periodic information may be required.

Table 2: Frequency of coverage by geographic and structural detail

	Level of geographic and structural detail			
Data Item	**Major production areas only- production by holdings**	**National coverage of production by holdings**	**Within country administrative areas— production by holdings**	**Inclusive of households and HH plots**
Crop A	**Annual**	**Annual**	**Decennial census**	**Decennial census**
Crop B	**Bi annual**	**Bi annual**	**Decennial census**	**Decennial census**
Crop C	**Decennial**			

Crop Z				
Livestock A				
Livestock B				

Livestock Y				
Aquaculture and Fishery				
Forestry				
Inputs				
Household income				
Change in Land cover				

Time and available resources result in a necessary compromise between frequency, level of geographic detail, and other breakdowns.

These categories need to be considered for each data item

89. At this stage, each country should have an overall picture of the content of its national statistical system for agriculture including the rural, forestry, and fishery components and the coverage and frequency for which data will be provided. Input from policy makers and other data users should shape this final picture.

90. The data user requirements, conceptual framework, and steps to determine the content of the national statistical programs have been defined. The following chapter provides the strategy and methodology to be implemented to integrate agriculture into the national statistical system and improve agricultural statistics.

Chapter 4: The Second Pillar—Integration of Agriculture into the National Statistical System

91. The purpose of this chapter is to provide an overview of the statistical methodology to improve agricultural statistics that will meet policy maker and other data user requirements using the conceptual framework as a base. The statistical framework will provide the blue print for the methodological requirements for agriculture in the National Strategies for the Development of Statistics. The integration and underlying methodology described below considers the quality dimensions which include relevance and completeness, accuracy, timeliness, accessibility, and coherence and comparability.

92. The process to improve agricultural statistics will begin with the integration of agriculture into the national statistical system. This integration will be accomplished by the development of a master sample frame for agriculture to ensure relevance and completeness, its use in implementing a coordinated data collection program to produce timely and accurate data that are coherent and comparable, and a strategy for data dissemination to ensure accessibility. This integration of agriculture into the national statistical system is needed for several reasons.

93. One of the shortcomings of current statistical systems in both developed and developing countries is that data collections across sectors are often done independently using different sampling frames and surveys leaving no opportunities to measure the impact of an action in one sector on another. Surveys are often conducted on an ad-hoc basis with no linkages to a master sampling frame or the use of geo-referenced units for data collection. It is therefore difficult to integrate data coming from various surveys for in depth analysis with cross tabulation of variables. For example, the data for the estimation of the production of crops and livestock come from surveys based on separate samples; therefore, there is no opportunity to analyze the economic characteristics of farms involved in both crop and livestock production vs. those specializing in only crop or livestock production and how agricultural production activities affect the well being of the farm and rural households and their foot print on the environment. Household surveys are often conducted in isolation from production surveys with no coordination or with sample sizes too small to disaggregate the data into the rural/farm sectors. The results generated from these surveys are also not integrated into a common data base for access by data users.

> ***Box 2. Reminder: The use of the word "agriculture" in the strategy is inclusive of the broader scope to include forestry, fisheries, and aquaculture as described in the Conceptual Framework—Chapter 2***

94. More than one governmental organization is often involved in the collection and analysis of agricultural, fishery and forestry data without coordination. While the National Statistical

Office may produce the agricultural census, the annual production data could come from the ministry of agriculture, and the contribution of the fishery and aquaculture sectors may come from another authority and may be ignored or neglected by the National Statistical Office. In some cases, different organizations produce statistics for the same items, with different results which confuse the data users and make it difficult to aggregate results across countries. This means that results then differ also at the international level if those organizations use different sources to populate their data bases.

95. The FAO World Program for the Census of Agriculture outlines several advantages of an integrated statistical system. Major reasons are to avoid duplicating efforts, prevent the release of conflicting statistics, and ensure the best use of resources. In addition, concepts, definitions, and classifications become standardized allowing a better collection of data across sources. These plus the requirements for data analysis all point to the need for the integration into the national statistical system.

96. In some countries, centralized organizational structures are already in place with National Statistical Offices having the main responsibility for agricultural statistics. However, this centralized role may not always meet the needs of the line ministries such as the Ministries of Agriculture. For that reason, the statistical responsibilities in many countries are decentralized with ministries of agriculture producing the agricultural statistics. Both systems have advantages and disadvantages. The National Statistical Offices have experience with statistical methodology and sample frames often not available in other ministries. However, the other ministries have more knowledge about agriculture, forestry, fisheries and land use. The purpose of the Global Strategy is to propose a framework for integration that builds off the strengths of both systems.

97. The integration of agriculture into the national statistical system will be based on statistical methodology using tools that establish a closer link between results from different statistical processes and different statistical units. This can be achieved by the development of a master sampling frame, the adoption of sample designs such as overlapping samples, and the synchronization of questionnaire designs and surveys. The master sample, sample designs, and the survey framework need to be considered together because there are choices such as using the same farms or households for different surveys, or using different samples and collecting some of the same variables across surveys. It is also necessary that countries have some flexibility in how the master sample frame and resulting survey designs are implemented to consider their national requirements as well as statistical capabilities.

98. The statistical methodology to be used also needs to consider some basic data quality dimensions—timeliness, completeness, comparability, and accuracy. Measures for each quality dimension will be considered in the development of the strategy. The following sections provide the strategy to create a master sample frame followed by the sample and survey frameworks to achieve the integration.

99. The following strategy also builds off recent and important developments for agriculture statistics that include the use of satellite imagery for monitoring land use, estimation of crop areas, and providing early warnings of changing growing conditions to name a few examples. In addition, the development of Geo-Position Systems (GPS) provides the possibility to geo reference observations and data collections to the land cover provided by the satellite imagery. The emergence of the internet and other technology such as the use of Personal Digital Assistants (PDA) equipped with GPS systems for data collection and their connection to data bases has tremendous potential for shortening the period between data collection and dissemination with improved data quality.

Strategy to Develop a Master Sample Frame for Agriculture

100. The development of the master sample frame for agriculture starts by defining the population parameters which are the physical land mass and natural environment of the country, the economic output of agriculture, and the well-being of the farm and rural populations. For data collection purposes, the population needs to be defined in terms of the unit of measure or the statistical units. The statistical units defined in the conceptual framework include the farm or agricultural holding, the household, and land parcels. The conceptual framework requires a linkage between the economic, environmental, and social dimensions and their statistical units; this brings the need for geo referencing the farms and households. All of these issues are considered in the development of the master sample frame.

101. Annex B provides an overview of the different approaches currently used by countries to establish sampling frames for agricultural statistics. The most common method used by developing countries is that the sample frame is essentially the enumeration or administrative areas used for the population and agricultural censuses. Samples of farms are obtained by first selecting enumeration areas, screening them for farms/households and then selecting a subsample for the surveys. Other countries prepare registers of farms for sampling purposes and must expend considerable resources to keep them up-to-date. A less used approach is an area sample frame, which is essentially the country's land mass divided into sampling units (Gallego 1995). Many of the requirements posed by the Global Strategy point to an increased use of area frame methodology. A final approach is to use multiple frames (FAO 1996) to create a master frame which builds off the advantages of area frames and registers.

102. The master sample frame must provide the basis for the selection of probability based samples of farms and households with the capability to link the farm characteristics with the household and then connect both to the land cover and use dimensions. The area sample frame meets this requirement. The methodology using the population census recommended for the *World Program for the Census of Agriculture* will also meet this requirement if—households from the population census are geo referenced and used as the frame for the agricultural census—and linked to satellite images of land use. At this stage, only a limited number of countries have included agriculture in their population census.

According to information currently available to the FAO, only 71 countries out of a total of 189 member countries have plans to undertake an agricultural census during 2006-2015. Given these constraints, the following paragraphs provide alternative methods to develop the master sample frame for agriculture.

103. The strategy to follow starts with a long term vision for how the master sample frame for agriculture should be developed. The strategy is mindful of differing levels of capacity between countries; therefore, alternative methods to develop the master sample frame are also provided.

104. The development of the master sample frame for agriculture builds off the requirement that the economic and social dimensions be linked to the environmental/land cover dimension which means the master sample frame should be linked to the land use. Therefore, a starting point for each country should be to first obtain satellite imagery covering the nation's land mass. The land cover as recorded by the satellite imagery should be classified by major categories such as cultivated land, woodlands. Grasslands, idle land, urban areas, etc. as described in the previous chapter. It should be noted that the imagery needs to be only updated periodically unless land use is changing rapidly. This first step to create the digitized land cover data base needs to be a central point in the statistical capacity building efforts.

105. Once the land use mapping is complete, the next step is to geo reference (or digitize) the population/agricultural census enumeration areas to the satellite imagery. In addition, administrative units such as countries, districts, townships, and villages should also be geo referenced so that they are associated with the land cover imagery. This provides the capability to monitor land use over time as it relates to the administrative structure of the country and becomes a component of the master sample frame for agriculture.

106. The following paragraphs outline several strategies to create a master sample frame. The first method starts with the long term goal to establish a linkage between the agricultural master sample frame and the population census as described in the *World Program for the Census of Agriculture* (FAO). Given the fact it is many years before that linkage can be made, additional strategies are also offered for: Countries with recent agricultural censuses; countries that use administrative data to construct a sample frame; and those that do not have recent agricultural censuses.

107. **Coordinated Population and agricultural census data collections.** The basic information that should be obtained in the population census is whether the household is associated with a farm, and if so, indicators of size, type, and the location of the land (census enumeration area or administrative unit). This can be be used to create a register of households/farms with their land linked to geo referenced census enumeration areas and/or administrative units. The non farm households falling into census enumeration areas containing agriculture should be included in the register. This will provide a linkage between

the agricultural data and all characteristics contained in the population register. While the linkage of farms to population census data provides a powerful tool for data analysis, several issues will need to be resolved. First, confidentiality rules may limit how the census data can be used to construct a master frame for agriculture. In addition, the register will need to be supplemented by a register of commercial farms not associated with households in order to provide a complete register for agricultural surveys. A more ideal approach would be to use the household/farm register as an input into the agricultural census. Then the master frame for agriculture would be the same as described below when a census of agriculture is the base.

Box 3: The Brazilian Institute of Geography and Statistics integration of the agricultural census with the population counting

- Integration facilitated by the use of PDAs equipped with GPS for data collection
- The list of agricultural 5.2 million agricultural holdings is referenced to the households listed in the population counting.
- Each agricultural holding can be visualized by means of Google Earth images combined with the grid of the agricultural census enumeration areas.
- The **list frame** of agricultural holdings with their respective coordinates and the set of enumeration areas surveyed by the agricultural census forms the **area frame and becomes the Master Sample Frame**

108. **Master Sample Frame with an Agricultural Census.** The development of the master sample frame using the agricultural census includes the need to associate farms with households and both to land use. Historically, the reporting unit for the agricultural census is the farm. The first step is for the data collection to not only define the farm along with obtaining production and economic information, but also obtain information about the household(s) associated with the farm and the household characteristics. The coverage of the census should be inclusive of both commercial and small scale farms plus subsistence farming households. The goal should be that the farms counted in the census be used to develop a register, and each farm should be associated with a household unless it is a corporate or institutional farm. A problem is that the point of data collection is the farm headquarters or household whose distance from the land holding poses difficulties for geo referencing each land holding to land use. Therefore, land associated with each farm and associated household needs to be linked to the appropriate geo referenced census enumeration areas or administrative units, or both. In this example, the master sample frame for agriculture will be a register of farms/households and commercial farm enterprises with their land geo referenced to enumeration areas or administrative units. Where the census is repeated on 10 year intervals, it will be necessary to update the register in the interim period using administrative information. An alternative procedure is to use two-stage sampling where

the first stage is census enumeration areas or administrative units. The first stage units could be screened annually for updating purposes.

Box 4. Note: The geo referencing of farms/households to the census enumeration and/or the administrative units which are part of the data layer in the satellite imagery in effect establishes an Area Sample frame—and becomes the Master Sample Frame for Agriculture.

109. **Countries using administrative data to construct registers of farms.** The procedures described above to develop a master sample using the census of agriculture should also be followed where administrative information such as tax records, licensing or regulatory registers is available. However, additional steps may be required if the administrative data do not include small or subsistence farms. This could include selecting samples of administrative units or census enumeration areas which would be screened for small and subsistence farms. As shown in the paragraph above, the geo referencing of the farms/households in the business register to either census enumeration or administrative areas in effect establishes an area sampling frame—which becomes the Master Sample Frame for Agriculture.

110. **Master Sample frame when there is not a recent agricultural census.** The starting point should be the development of an area sample frame. The geo referenced satellite imagery by land use category can also be used as the basis for an area sample frame as described by Gallego (1995). The land use characteristics of the country should be used to determine the choice of sampling unit—segments with identifiable boundaries or a sample of points. Either method with rules of association during data collection can be used to assign both farms and related households to the segment or point which will be already geo-referenced to land use. The data quality dimension of completeness is satisfied because the entire country has been mapped. The requirement for comparability is also met because the same segments or points can be used for multiple surveys and over time. Once the country has established the area frame, it could begin creating a list register of large or specialized farms to use in a multiple frame context. Nevertheless, **the area frame described above becomes the master sample frame for agriculture** with the capability to directly link or geo reference the farm and household with their associated land holding. This is a key advantage where the households can be located in villages some distance from the land holding. The sample segments or points should also be associated with the census enumeration areas or administrative units. The linkage of the sample units with census enumeration areas also puts the master frame into the population census framework.

111. In summary, the master sample frame for agriculture can be established several ways. The common element for the three methods provided above is the geo referencing of census enumeration areas and administrative units to digitized satellite imagery classified by major land cover. The area frame sampling units can be directly associated with the land cover classification. The land associated with the farm/household/ enterprises from the census or administrative registers is indirectly associated to land cover via the mapping to the census enumeration area or an administrative unit. A longer term goal would be to geo reference each parcel associated with an agricultural holding directly to the satellite imagery.

112. Once the master sample frame of farms and households has been established, the next and longer term step is to create a register of agricultural enterprises that furnish inputs, provide transportation, and are the first stage processors of crop and animal products.

> **Box 5. Master Sample Frame**: The underlying principle is that the Master Sample Frame be the source for all samples for surveys of agricultural holdings, farm households, and rural non farm households. This means the samples can be designed so that data can be analyzed across surveys. Once the master sample frame has been developed, it should be possible for different institutions in the national statistical system to access the master sample for survey purposes with another guiding principle that the resulting data be available for analysis across other data collections.

113. The Master Sample Frame enables the use of a rich assortment of sample designs including single vs. multiple stage sampling. If enumeration or administrative areas are the first stage of sampling, they can be selected with probabilities proportional to measures of size coming from the population or agricultural censuses. The use of enumeration or administrative areas provides a means of either selecting farms, households, or a combination of both as the statistical unit.

114. Households, holdings, and enterprises may not be suitable sample units for surveying capture fishery production, while the master sample frame will be efficient for monitoring all the other aspects of fishery sector. When utilizing landing sites as the sampling unit for data collection of capture production, the survey on the other aspects of fishery sector will need to include questions about the landing sites used by each household, holding and enterprise to allow integration of two different sampling schemes.

Strategic Vision for the Integrated Survey Framework

115. The purpose of this section is to provide the strategy for the integrated survey framework. The complete survey framework includes the sample design, questionnaires, data collection methods, analysis, and estimation. It also takes into consideration the data sources in addition to sample surveys that provide input into the survey framework. The overall strategy is presented; the technical and methodological elements will be part of the implementation plan.

116. Timing and frequency of data collection are issues for much of agriculture. Crops have different production cycles that are seasonal while livestock production is determined by not only by the respective reproductive cycles, but also the continuous production of commodities such as milk and eggs. Aquaculture has similar characteristics as livestock production. The rural labor force is also affected by the seasonal nature of agriculture

affecting the opportunities for work and earnings. The timing of data collection affects the quality of the data, especially if a lengthy recall is required. As a result the data collections should coincide with the recent harvest periods. For example, if crop yields are determined by crop cutting surveys, then these have to be done shortly before harvest. Capture production requires frequent samplings and surveys, e.g. twice a week, or every 5 days, to reflect frequent and unpredictable changes of catch species composition and resource availability in addition to seasonality.

117. The preparation of the integrated survey framework begins by first considering the set of core data requirements followed by the additional information needed by each country as summarized in Table 2 above showing by item the frequency of coverage, geographic detail, and inclusion of commercial agriculture vs small and subsistence farms.

118. The minimum set of core data includes statistics about production of major crop and livestock items, aquaculture/fisheries, and forestry products. The second requirement is for data about the economic situation of the agricultural holding, including inputs and outputs. The third requirement is to collect data on the use of fertilizers, chemicals, tillage methods, and other land use activities to monitor agriculture's affect on the environment. The fourth requirement is to measure the social well being of the farm and rural households. The traditional methodology is to select independent samples and conduct separate surveys for each of the several categories. While the optimum sample design often leads to the selection of samples specific for crops, livestock, and the respective economic, environmental, and social surveys, it is limiting for data analysis purposes across the different issues.

119. Single purpose surveys are generally conducted because that makes it easier to target the sample selection to specific characteristics such as crops or livestock especially where both are not present on most farms and when present may differ considerably in size. It is difficult to use stratified designs using many different measures of size. Recent developments in sampling theory provide an alternative using selection probabilities based on the measures of size for a number of different variables. This design is termed "Multiple Probability Proportional to Size" (MPPS) because the relative size of each farm (or enumeration area) is determined for more than one item of interest. The use of this method in China is described by Steiner (2007). It takes advantage of efficiencies of Probability Proportionate to Size sampling while adding the use of multiple measures of size. The use of MPPS is appropriate for multiple purpose surveys where the population sample units each only have a subset of the items of interest.

> Box 6. China's Integrated Statistical System
>
> MPPS sampling using multiple variables from the Census of Agriculture is used to support an expanded survey program and to integrate the statistical needs for different levels of government.

120. For data analysis purposes, it would be desirable to select one large sample which would provide all of the data for production, the economic situation of the holding, the environmental impact, and the social-well being of the household. It would also be desirable for the same sample to be used over time for longitudinal data analysis. While the MPPS sample design provides the basis to use a single sample, it requires lengthy and complex questionnaires to include all items of interest at the same time. Therefore, the following paragraphs describe a strategy to collect data for some core items annually coupled with a periodic data collection or the remaining items in a way that provides analysis capabilities across subject matters.

Steps to implement an integrated survey framework

121. The integrated survey framework should be based on the minimum set of core and national data and the determination of the frequency requirements.

a. Determine the set of core items for which at least annual data are required. For those core items not needed annually, group them by category including economic variables such as farm structure expenditures and income; environmental measures such as the use of fertilizers and chemicals and land and water use; Social variables such as household income and well being; and other items of national interest (minor crop/livestock items, for example). Data for these items will come from rotating panel surveys based on a subsample of the core survey.

b. Select a replicated sample for the annual core items using MPPS. In other words, instead of selecting one large sample, select several replicates. As shown below in Figure B, this allows a process to include some of the sample units in the survey across time for longitudinal analysis. Diagram B shows 12 replicates; 1 through 5 for year 1, 2 through 6 for year 2, etc. This provides longitudinal data, but also limits the number of times for respondent burden considerations.

c. Design a survey questionnaire to obtain the annual core data items. Each year the core questionnaire should contain supplemental questions regarding one of the subject matters described above. For example, in year one replicates 1 through 5 will be surveyed using the core questionnaire which will also contain key questions about economic variables. The core questionnaire can either obtain all information required, or a subsample could be selected for the collection of the detailed data. In year 2, replicates 2 through 6 will be surveyed using the core questionnaire which will contain questions about environmental issues. By year 4 all of the subject matters will have been included.

d. Each year, one of the sets of panel data will be linked to the annual core items. Also note that starting with year 4, at least one of the replicates will have been

surveyed by all of the rotating panel questionnaires in addition to the core questions.

122. Table 3 provides an overview of a survey framework based on replicated samples which are surveyed each year for the annual core data items. In addition, each year the core questionnaire contain a set of supplemental questions for one of the subject matters that round out the minimum set of core data.

Table 3: Example of a replicated survey design with the use of an annual core questionnaire and rotating sets of supplemental questionnaires.

Replicate / Year	**Rep 1**	**Rep 2**	**Rep 3**	**Rep 4**	**Rep 5**	**Rep 6**	**Rep 7**	**Rep 8**	**Rep 9**	**Rep 10**	**Rep 11**	**Rep 12**
	Every replicate receives same core questionnaire every year for annual core data items. Each core questionnaire contains questions about the rotating panel surveys for subsampling											
1	**A**	**A**	**A**	**A**	**A**							
2		**B**	**B**	**B**	**B**	**B**						
3			**C**	**C**	**C**	**C**	**C**					
4					**D**	**D**	**D**	**D**				
5					**A**	**A**	**A**	**A**	**A**			
6						**B**	**B**	**B**	**B**	**B**		
7							**C**	**C**	**C**	**C**	**C**	
8								**D**	**D**	**D**	**D**	**D**
9									**A**	**A**	**A**	**A**
10										**B**	**B**	**B**
11											**C**	**C**
12												**D**

Detailed Questionnaires for

Rotating panel surveys

A. Economic items including Farm structure, expenditures, income

B. Environmental items including inputs, chemicals, tillage, water use, land use

C. HH income, consumption, employment

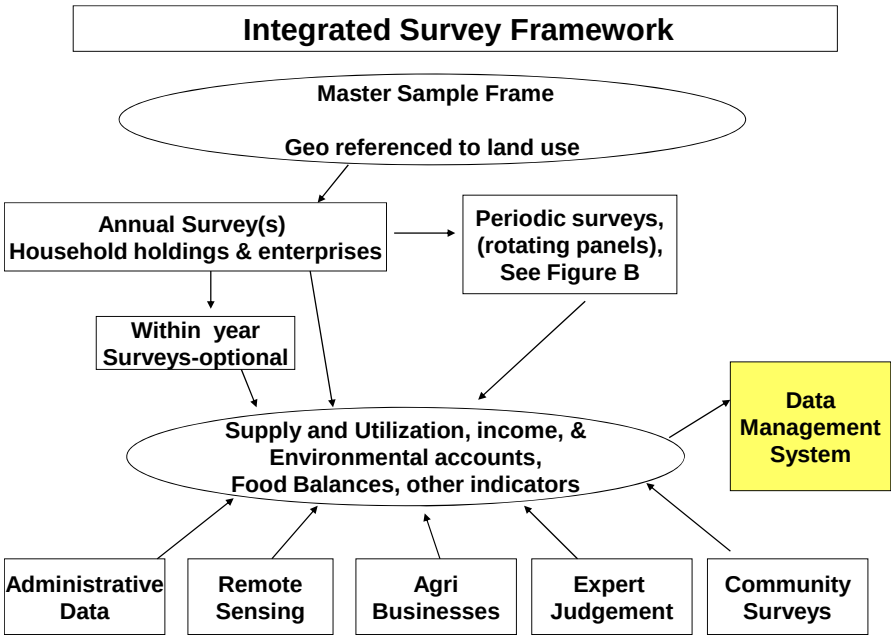
D. Items of national interest

123. The above survey design provides a strategy to collect data for core items—some annually, others on a 4 year rotating cycle. Each country will need to make its own decisions about the content of each of the components. Once the above design is in place, the next consideration is whether some of the data collections for the annual core items should take place more frequently during the year. One example would be to conduct a midyear survey to determine crop yields before harvest, another to obtain the final production and stocks.

124. The integrated survey framework also offers the opportunity to compare sample unit data across time providing a major validation tool to improve data quality. The integrated framework also provides the opportunity to use alternative estimators. While the direct unbiased estimators based on the sample design form the foundation, they can be supplemented using ratio and regression estimators, and/or model based estimators using census results. The use of multiple estimators can improve data accuracy and reliability.

125. The integrated survey framework shown in Figure B below provides an overview of how the annual and periodic surveys are connected in the data system. Note that within year surveys can also be conducted using subsamples from the annual survey.

Figure B: The overall integrated data system



126. The survey framework also takes into account the additional data sources that need to be included in the overall framework. These include:

a. **Administrative data**. Governmental interventions such as subsidies, regulation, and legislation often require agricultural holders to report production information. Land ownership and cadastral surveys provide useful information for constructing registers. Food inspections, animal health inspections, and trade data provide input to the utilization accounts.

b. **Remotely sensed data** include vegetative indices that show overall crop conditions plus information about changes in land cover and use. The survey framework should include the need to provide ground truth data if remote sensing information is to be used to estimate cropland areas.

c. **Agri-businesses** are the source of utilization data and prices.

d. **Expert Judgement/Windshield surveys** refer to the input from expert judgment to evaluate agricultural conditions. The Source book refers to a procedure where experts travel a specified route on a periodic basis and record the condition of crops, which provide an input into crop yield forecasts.

e. **Community surveys**--The World Programme for the Census of Agriculture provides an overview of data that can be collected at the village level. These data include information about the infrastructure and services available to households and agricultural holdings, occurrences of food shortages, frequency of natural disasters, etc.

127. The integrated survey framework will provide annual data for a core set of items on agricultural production and other variables determined by the national statistical system. The survey framework provides the capability for longitudinal analysis of the core data plus provides linkages to the data collections for economic, environmental, and social issues. The use of the master sample frame ensures that the data collections are connected to land use as well. The remaining pillar of integration is the management of the data to maximize their use for data analysis.

The Data Management System

128. The data management system should provide three capabilities—access to official statistics for dissemination purposes, provide for the storage and retrieval of survey results, and enhance access to farm/household and geo referenced data for research and data analysis.

129. The first capability is to support the data dissemination function to ensure the official statistics are readily available, clearly identified by source and time, and are comparable for aggregation purposes, both within and across countries. If more than one institution is involved in the national statistical system, there should either be a single data base, or the data bases be coordinated so that there is no duplication of official statistics that can lead to different numbers being made available leading to confusion among the data users. These data should become part of FAOSTAT, which becomes a public good for data access.

130. The second requirement is to provide the framework for the storage of the aggregated survey results and geo referenced land use data along with the supporting administrative

and other data sources. Not all survey results are published, however, they should be available for research and analysis purposes. As described above, the sample and survey design enables the use of ratio and regression estimators requiring linkage to previous data.

131. The third requirement is to build off the capabilities provided by the master sample frame's linkage to land use. The data management system should provide for the storage and maintenance of the farm/household survey data and provide the linkage between the different sets of data that are geo referenced to a common land use. For example, there will be five consecutive years of core production data for the same sample units plus data from the rotating panel surveys. The strength of the integrated survey system will come from the data analysis capabilities provided by this data set.

132. The data management system needs to also contain the other data dimensions, namely, the administrative data and other sources spelled out in diagram 3. This will enable the compilation of Supply and Utilization Accounts, Food Balance Sheets and other economic and environmental accounts. The use of these accounts provides a means to ensure the consistency of data from various sources. At the same time they help to integrate agricultural statistics into the national statistical system by compiling them in parallel with indicators from other sectors that follow the same concepts, definitions, classifications, and accounting methodology.

133. The value of the integrated data base will increase over time as it grows. It will not only provide more analysis capabilities across time, it can be used to improve data quality by comparing survey information with census data or between surveys over time. The output of the aggregated values will be the input to Country Stat following its methods and principles.

134. The integration of agriculture into the national statistical system through the implementation of a master sample frame, the integrated survey framework, and the integrated data base will require countries to review their current governance structure and if necessary make changes to meet the challenges for coordination and to ensure the statistical system is sustainable.

Chapter 5: The Third Pillar –The Sustainability of Agricultural Statistics through Governance and Statistical Capacity Building

135. The third pillar of the *Global Strategy* is the foundation required to ensure the sustainability of agricultural statistics. The first pillar—determining a minimum set of core data—provides a baseline of data to be used as a starting point to develop a sustainable statistical system. The second pillar--the integration of agriculture into the national system—lends strength to the ability to maintain a sustainable

statistical system by the shared use of a master frame and integrating data requirements.

136. While donor funding and support will continue to be essential to improve the national statistical systems, the goal should be that the collection of the core data through the use of the master sample frame and integrated survey frame work be sustainable over time with national resources. A statistical system that is not sustainable because of unpredictable funding leads to a significant risk that data collections will not follow the appropriate intervals, therefore, disappointing policy makers and other data users leading to their lack of support for the statistical system. The integration of agriculture into National Statistical System will require many countries to develop an adequate governance structure across the different institutions involved and the building of statistical capacity.

137. It was pointed out in Chapter one that the lack of demand within countries and from the international community is an important underlying factor explaining the lack of financial support to agricultural statistics. Therefore, a key element for a sustainable agricultural statistics system is understanding the demand for statistics at the national level and supplying the data to meet those needs. Demand can be supported and strengthened if the statistical system is responsive to users and provides statistics that are relevant, accessible, timely, and with a level of accuracy to meet their needs.

Governance

138. As stated before, usually more than one governmental organization is involved in the data collection and analysis for agricultural, forestry, and fishery. In some countries, centralized organization structures are already in place with National Statistical Offices having the main responsibility for agricultural statistics. However, there may still be a need for a coordination mechanism to ensure that the statistical system fully meets the needs of line ministries. In the majority of countries, however, the statistical responsibilities are decentralized with ministries of agriculture producing the agricultural statistics. Both systems have advantages and disadvantages. The National Statistical Offices have experience with statistical methodology and have sample frames often not available in other ministries. However, the other ministries have greater knowledge about agriculture, forestry, fisheries and land use. The purpose of the Global Strategy is to propose a framework for integration that builds off the strength of both systems.

139. Governance needs to begin at the national level and deal with how to organize a national statistical system around the ministries involved in data collections for the different sectors included in the agriculture domain. It should address and ensure proper integration of agriculture in the preparation of the National Strategies for the Development of Statistics.

140. A coordination mechanism is needed that includes the different data producers to ensure the use of common standards, avoid the duplication of resources, prevent the publication of conflicting data from different ministries, and ensure statistical integrity by making the data available and accessible. The coordination mechanism should provide a common voice for seeking resources for the agricultural statistics system within the framework of the national statistical system

141. The National Statistics Council could include the Ministry of Agriculture, the National Statistical Office, and other organizations providing statistics or administrative data to jointly organize and coordinate the development and use of the master sample frame, the integrated survey framework, and data base. It may be determined that some ministries are best suited for some activities such as the master sample frame, or to conduct specific data collections. The basic concepts in the guiding principles will need to be honoured; that is data collections will be based on the master sample frame in an integrated survey system with the outcomes stored in the integrated data base. The role of each institution should be clearly defined and build on their strengths in terms of technical expertise and subject matter knowledge (crops, livestock, aquaculture and fishery, forestry, land, and water).

142. The integration of agriculture into the national statistical system does not mean all responsibilities fall on the National Statistical Office, the Ministry of Agriculture, or other ministries. However, it does mean that the organizations with overlapping data needs accept the master sample frame, integrated survey framework, and data base principles.

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143. The integration of agriculture into the national statistical system has several implications for international organizations. They will need to work within the governance structure established for each country for their data requests rather than going to each sector. It will also lead to the international organizations coordinating their data needs to minimize the data reporting responsibilities of the national statistical system.

144. The strategy has implications for donor organizations, including those supporting statistical capacity building,again their efforts will need to focus on the governance structure each country has organized rather than going directly to individual sectors.

145. The National Statistics Council will need to deal with the following cross-cutting and coordination functions:

a. Prepare or revise National Strategies for the Development of Statistics identifying the respective roles of each organization in the National Statistics Council.

b. If necessary, implement or revise legislation regarding the authorities and responsibilities for statistics. This should include legislations or regulations regarding confidentiality of data.

c. Develop the strategy to seek policy maker, data user, and public support for the funding requirements for a sustainable statistical system. The goal is to increase country ownership of the planning process to produce statistics and the outcome.

d. Provide common standards, salary scales, and professional requirements across the organizations in the national statistical system for agricultural statistics.

e. Determine who does what regarding the development and maintenance of the master sample frame, determining the framework of the integrated surveys to be conducted, and the responsibility for the data management system.

f. Agreement on the content, scope, coverage, and frequency for which data will be provided by the national statistical system in addition to the core data based on policy maker and other data user requirements.

g. Establish a framework to ensure the provision of data is user driven and responsive to their requirements for timeliness and quality.

h. Work with the FAO, other international organizations, and donors to prepare a detailed assessment of the current national capabilities and prepare a framework for statistical capacity building.

i. With input from international and regional organizations, determine funding requirements for capacity building, development of the master sample frame, and the costs to sustain a survey system.

146. The integration of agriculture into the national system will change the focus of statistical capacity building which currently focuses mainly on the national statistical offices. The inclusion of agriculture statistics in the national statistical system means that it must also be a primary element of the National Strategies for the Development of Statistics.

Statistical Capacity Building

147. The strategy, which includes the use of remote sensing, the concept of a master sample frame and the challenge to design an integrated survey framework and data management system calls for expertise difficult to maintain in many countries. This raises questions about the establishment of regional centers of excellence for remote sensing, statistical methodology, and information technology to provide national support. The establishment of these centers could be a focal point for support from donors and international organizations.

148. The success of the global strategy will require a national and international effort and commitment to implement the statistical capacity building required to rebuild the statistical systems in some countries and make improvements in other countries where needed. The implementation of the *Global Strategy* should build on a detailed country assessment that will define specific actions at country, regional, and international levels to identify priority areas, resources required and the timeframe. For many developing countries, assistance from donor agencies and technical cooperation agencies will be needed to support the initial phases of capacity building. This capacity building includes many things starting with the support to:

    a. Develop National Strategies for the Development of Statistics if not available; if available, review them to determine where revisions are needed.

    b. Build an infrastructure of statisticians and supporting staff including data collectors.

    c. Educate staff on statistical methodology for sampling, survey design, data compilation,and data analysis.

    d. Develop and maintain the master sample frame, implement the new survey framework, and development of the data management system.

    e. Provide computers, software, and other technical equipment.

    f. Provide the satellite imagery geo reference by land use.

    g. Disseminate the results and respond to requests.

149. The *Global Strategy* is a long range plan that will face many challenges requiring a concentrated effort from all stakeholders.

Chapter 6: Challenges Remaining and the Way Forward

150. The statistical capacity and implementation steps should include a data quality dimension which for agricultural statistics will consider: accuracy; relevance,

timeliness; comparability; and availability and accessibility. A guiding principle will be that the assessment of the quality dimensions will be data user and customer driven.

151. The dimensions of accuracy and timeliness pose a dilemma for agriculture because of the seasonal nature of production which requires a compromise. It will be necessary to determine from the data users their requirements for timeliness which will influence the overall accuracy. A very important element of timeliness is the publication of a calendar showing the dates results will be published.

152. The comparability element means that data are not only comparable across countries, but also over time. This poses another dilemma because of the dynamic nature of agriculture may not always allow a long time series of data. It will pose a dilemma when the methodology from the strategy is implemented. Again, final decisions need to be user driven.

153. The concept of availability has two dimensions; the release of official statistics and the availability of micro data for research and analysis purposes. Official statistics are a public good and should be made equally available to all.

154. However, the access to micro data raises issues with data confidentiality. The guiding principles in the "Fundamental Principles of Official Statistics" presented by the UN Statistical Commission include the requirement that individual data collected by statistical organizations be strictly protected and used exclusively for statistical purposes. This raises the issue of a data access policy because in order to integrate statistical data with data collected by other specialized agencies such as the fishery agency, to understand some policy issues or to advance the boundaries of research, it is necessary to have access to household or enterprise level data. Through the International Household Survey Network, tools for documenting and disseminating micro data according to international standards and practices have been developed. Each country will need to determine a data access policy that provides access to micro data within its confidentiality requirements.

Remaining Challenges

155. The strategy does not solve methodology problems for data collection. Crop yield estimation is still very difficult, especially for root crops, where mixedcropping is used, and harvesting in continuous. In many countries, the producers cannot provide a measurement of area in standard units. Challenges remain to reach the potential of remote sensing which still cannot provide estimates of area by individual crops. The integrated survey framework will provide challenges for

sample design, and determining what types of data can be included in an integrated survey questionnaire.

156. Support for methodological research at regional and global levels will be also required to prepare technical guidelines in areas such as the use of remote sensing, development of the master sampling frame with geo-referenced statistical units and master database, integrated household surveys, crop yield estimation in difficult conditions such as mixed cropping, root crops, and continuous harvesting.

The Way Forward—the Implementation Plan

157. There are elements of the strategy that countries can begin immediately to review. One is to review the menu of indicators and suggested set of core data items with policy makers and other data users. The on-going work of Wye City Group on *Statistics on Rural Development and Agricultural Household Income* should provide an important input to this process. The other issue is to begin the dialogue with other institutions producing agricultural statistics about the integration of agriculture statistics into the national statistical system.

158. The Global Strategy is a document that not only provides the vision to improve agricultural and rural statistics, but some concrete recommendations described above about the three pillars—core, integration, and sustainability. Following the adoption of the Global Strategy, the follow steps will be taken:

    a. FAO will take the lead to develop an implementation plan in conjunction with relevant regional and international organizations.

    b. This implementation plan will provide the framework for countries to prepare detailed action plans within a period of six to 12 months after the strategy is approved and launched.

    c. The FAO will provide an inventory of relevant initiatives conducted by it and other organizations, and include the work underway by the Wye Group.

    d. A set of research and technical develop requirements needs to be identified so that they can be taken into account in the future work programs of the FAO, other regional and international agencies, and donor organizations.

    e. A report will be submitted to the 2011 UNSC on progress made by 2014.

159. The **Implementation plan** provides a starting point for combined efforts of the national statistical system and international stakeholders. This implementation plan should include the coordination of efforts of donor organizations. This effort should

begin with a complete country by country assessment of their current situation, and develop national plans to implement the *Global Strategy.*

160. The *Global Strategy* and implementation planning efforts should provide the main focus for October 2010 meeting of the International Statistical Institute Conference on Agricultural Statistics (ICAS-V).

161. The *Global Strategy* provides a ground-breaking effort to improve agricultural statistics that has implications for other sectors in the national statistical system. While it took many years for agriculture statistics to erode to the current situation, the implementation provides a fresh start. The *Global Strategy* should be considered to be a living document that will be revised as issues emerge.

Annex A. Menu of Indicators for Agricultural Statistics

Table 1: Menu of indicators, data requirements, data sources and technical notes[5]

	Indicator	Data Requirements	Data Sources	Technical Notes
	Sector Wide indicators for agriculture and rural development			
1	Gross Domestic Product (GDP)—		Censuses and surveys of firms, farms, and households for small holders.	Value added should include unreported activities as well as the value of informal or small scale operations. Annual estimates between census or surveys based on extrapolations based on other indicators.
2	GDP growth from Agriculture value added.	Estimates of total production and value for all commodities produced in the country; including that from small holders/household plots minus estimates of the cost of inputs such as seed, feed, energy, fertilizer, labor, etc. Agriculture includes	Censuses and surveys agricultural enterprises, farm and rural households, administrative and processor. data	SNA concepts followed. Problems include estimation of output consumed by the household and the annual coverage of all commodities for which only periodic census data are available. Annual estimates made using previous census and other administrative data if available.

[5] Indicators should be disaggregated by gender.

	Indicator	Data Requirements	Data Sources	Technical Notes
		forestry and fisheries		
3	Amount of public spending on agriculture, subsidies, and infrastructure	Government budget allocations, and spending related to agriculture. Agriculture includes forestry and fisheries	Ministry of Finance, National Accounts, Planning commissions, Donor reports	The definition for public spending on agriculture should follow the UN Classification of Functions of Government (COFOG) for agriculture
4	Amount of public spending on rural infrastructure including health and education	Government budget allocations, and spending related rural areas	Ministry of Finance, National Accounts, Planning commissions, Donor reports	Rural defined using national description
5	Change in Investment in capital stock	Inventories of machinery and equipment owned by agricultural holdings, buildings such as milking purposes, animal breeding stock, area of semi-permanent crops such as trees and vineyards, number of trees and vines	Agricultural resource surveys of holdings and agricultural enterprises	Machinery and equipment inventories should be by purpose (tillage, harvesting, etc.) and size
6	Demographics of agricultural and rural population	Rural population and number of rural households, , number of agricultural households and population living in them, age and education levels. Agriculture includes forestry and fisheries	Census of Population, Census of Agriculture, Household surveys, administrative records	Rural defined using national description
7	Rural poor as a percent of total poor population	Household income and consumption estimates for national and rural poverty lines. Purchasing Power Parities for comparisons across countries	Household Surveys. International Comparison Program for comparisons across countries	Countries should use poverty estimates based on PPPs and extrapolate between ICP benchmarks
8	Rural hungry as a percent of total poor population	Household income and food consumption estimates for national minimum energy	Household Surveys. International Comparison Program for comparisons across countries	Countries should use hunger estimates for monitoring food deprivation levels

	Indicator	Data Requirements	Data Sources	Technical Notes
		requirements.		
9	Food production index	Area, production and yield for food crops, livestock numbers and production of meat, milk, eggs, fish captured and cultured, and other food products, non-food use of food products, food imports and exports	Agricultural Census, surveys of agricultural enterprises, processors, fish landings, administrative data such as imports, exports. Food Balances and Household consumption surveys	Follow FAO guidelines for inclusions and exclusions
10	Change in value of Trade—imports and exports	Imports and exports—quantities and values of agricultural products including fishery and forest products	Customs inspections—in some countries the customs offices collect the data which then are turned over to the national statistical office for compilation	National statistical offices should collaborate with customs officials to ensure coding and classifications follow international guidelines
	Indicators for subsectors of agricultural and rural			
11	Productivity of Crop production as measured by crop yields	Quantity harvested per unit of area such as hectare and area harvested. Area harvested, distinguished between irrigatedharvested crops and rainfed harvested crops	Census of Agriculture, crop cutting surveys. Production sample surveys, processor surveys, such as oil seed crushers, cotton ginners	Difficult to measure with mult-cropping or with crops that can be harvested > once a year. Crop cutting can over estimate yields
12	Change in components of crop balances	Area Harvested, Quantity harvested, quantities imported/exported, change in stocks, quantities by utilization such as food, bio fuels, own consumption, for every crop including those produced for fiber and oil	Surveys of agricultural enterprises, administrative data on trade, processors by utilization, household surveys for own consumption	Crop balances should reflect the growing cycle and marketing year which could be different from the calendar year.
13	Livestock value added	Estimates of quantity and value of production of meat, and poultry, milk,	Surveys of agricultural holdings, enterprises such as slaughter plants,	Own consumption should be included, difficult to measure.

	Indicator	Data Requirements	Data Sources	Technical Notes
		eggs, by products such as hides and skins, wool mohair minus costs of inputs such as feed and replacement stock	dairies, processors. Household surveys for own consumption	
14	Change in components of Livestock and poultry Balances by species	Number of animals born, acquired, slaughtered, deaths from disease. Number of animals by purpose such as breeding, meat, milk, wool, and by age breakdowns relevant to specie. (see FAO 2010 Census)	Surveys of agricultural holdings at least annually but more often for species with more frequent births during a reference period. This ranges from annually for cattle to monthly for egg production.	Data collection intervals should reflect the reproductive cycles. This suggests annual for cattle, semi- annual for pork, quarterly or shorter for poultry, milk,
15	Change in productivity of Capture Fish production	Quantity of fish taken by unit of fishing effort; Scientific estimates of fish stock and exploitation rates;	National fishery surveys, surveys at landing sites, on-board observers, national, regional and global assessment results;	
16	Change in productivity of aquaculture	Estimates of quantity and value of production of fish by species minus costs and quantity of inputs such as seed, feed and fertilizers	Surveys of aquaculture enterprise, and holdings, aquaculture census, market certifications,	
17	Change in components of fish balances	Quantities and value of captures form coastal and offshore waters, rivers and lakes including non-landed catch; Quantities and value of products from aquaculture; utilizations including own consumption and discards, imports and exports, inputs such as seed and feed; outputs such as stocking; for each aquatic species	National fishery surveys, fishery census, aquaculture census, surveys of fishery and aquaculture enterprises, , processors, market information, administrative and inspection sources	See CWP Handbook, FAO coding and classification
18	Change in components of	Quantity and value of removals of products	Appropriate ministries, satellite imagery, price	

	Indicator	Data Requirements	Data Sources	Technical Notes
	forestry balances	from forested areas and respective utilizations	surveys or processor data	
19	Commodity Price indexes	Market reports of prices being offered by commodity and location. Prices received by the enterprise at the first point of sale,	Market observers, Surveys of enterprises, agro enterprises purchasing commodities from agricultural enterprises	Care needed to ensure units of measure for pricing are comparable
20	Consumer Price indexes	Monthly/seasonal prices paid by the consumer	Consumer Price Index,	Care is needed to ensure highly seasonal products do not distort the price series.
21	Early warning of change in food security	Monthly/seasonal prices paid by the consumer	Windshield surveys of crop conditions, amount of precipitation, satellite imagery of vegetative indexes, changes in trade data, animal disease outbreak	These do not have to be statistically rigorous, mainly to provide an early warning that other interventions are needed
	Climate Change, land, and the environment			
22	Change in Land Cover and use	Land Cover Classification System (LCCS), Area and geo-referenced for Cultivated land, Grass/pasture, inland water, marine water, wetlands, shrubland, woodland, fallow/idle cultivated land, barren land, urban/developed areas, areas equipped for irrigation.	Land use surveys, satellite imagery. Geo referenced data on economic situation of agricultural holdings needed to understand effect of policy decisions on land use.	Ground truth data required to provide more detailed breakdowns of cultivated land, especially for crops in small plots. Difficult to apply in detail where multi- cropping is used.
23	Change in proportion of land area covered by forests, rate of deforestation	Area geo referenced to map materials	Ministry responsible for forestry, satellite imagery	Follow LCCS classification
24	Percent of land and water area formally established as protected areas	Land and water area and geo referenced to mapping material	Responsible ministry—satellite imagery	Follow LCCS coding with expansion covering inland and marine water bodies

	Indicator	Data Requirements	Data Sources	Technical Notes
25	Irrigated land as percent of total cropland Productivity of irrigation	Total cropland and area irrigated by source of water for irrigation— (surface water, groundwater, treated wastewater, etc.) - by method (surface, sprinkler, localized irrigation) Crop yields from irrigated land compared to yields from non irrigated areas.	Agricultural Census, other crop related surveys or water user survey	irrigation refers to the artificial application of water to assist in the growing of crops (and pastures). Can be done by letting water flow over the land ("surface irrigation"), by spraying water under pressure over the land concerned ("spinkler irrigation"), or by bringing it directly to the plant ("localized irrigation")
26	Withdrawal of water for agriculture as a percent of total water withdrawal	Area under irrigation, number of irrigations, irrigation intensity and requirements by crop, water withdrawal and turn over rate for aquaculture consumption, per capita consumption by people and animals	Appropriate ministries, special studies or surveys to estimate water use in agriculture and aquaculture, surveys of aquaculture enterprises and holdings.	Should include both surface and ground water. Coding and classifications should be defined
27	Change in soil loss from watersheds	Reduction in crop yields, reduction in area of cultivated land	Appropriate ministries, geo referenced data with satellite imagery	
28	Change in affect of inputs on the environment	Fertilizer, pesticide, and other chemicals applied to the soil, water bodies, and plants by type of crop and watershed area, stocking	Agricultural census and or follow-up surveys to measure fertilize and chemical use, tillage methods	Data should be geo referenced to land cover and use
	The agricultural and rural economy			
29	Number of family and hired workers on the holding	Include Unpaid labor of the operator of the holding and family members plus number of hired workers	Labor force surveys of holdings	Need to establish standards for minimum ages of workers and the number of hours worked per week to be considered a worker. Need to ensure female workers

	Indicator	Data Requirements	Data Sources	Technical Notes
				are counted
30	Number of household members employed by farm and non farm	The employment status for work off the agricultural holding for each household member	Labor force surveys—household surveys	
31	Change in Farm and Rural non farm household income from all sources	Income to the household by sector, crop, livestock, etc. Income from investments or employment outside the agricultural holding	Rural Household Survey.	Rural to be classified using range in population density.
32	Percent of rural population using services of formal banking institutions	Total number of rural households, number using credit or savings services	Central Bank or commercial banks, special surveys, agricultural census	
33	Change in sales of agro enterprises	Sales, net profits of enterprises providing services to agriculture	Special surveys	Use standard accounting principles

Annex B. Examples of Sample Frames used for Agricultural Statistics

Population census enumeration areas. The population census is usually conducted using an administrative structure where cartographic or other mapping materials are used to divide the country into enumeration areas which is the first level of data aggregation. Depending on the country's capabilities, the only results from the population census in some countries are the enumeration area totals for numbers of people, households, etc. Therefore, the sampling frame is basically the listing of enumeration areas and associated aggregated data from the census. Random samples of enumeration areas are selected and screened for households from which subsamples are selected for household surveys--a two stage sampling process. Some countries use their administrative structure of counties, townships, and villages as their framework for the census with the village becoming the enumeration area. Villages are also used as a first stage sampling unit in countries where the village is where the farm households are generally located.

Household registers from the population census. Countries with the statistical capacity are able to develop a register of all households included in the population census. The list of population households is the sample frame used for household surveys. One problem is that the list of households becomes out of date with households changing or dissolving and new households formed. Unless administrative data or other means are used to keep the population register up-to-date, survey results contain an increasing coverage bias over time.

Agricultural census enumeration areas. In many countries, the cartographic materials and data from the population census are used for the agricultural census. The sampling frame consists of enumeration areas and aggregated data from the census data collection. As in (a) above, random samples of enumeration areas are selected and screened for farms or agricultural holdings for agricultural production surveys.

Registers of farms from the Agricultural census. As in (b) above, countries with the capacity use the agricultural census to develop registers of farms. This provides a powerful sampling tool because it allows a choice of many alternative sampling designs. A major weakness is that the registers rapidly become out of date. Out of date population and farm registers erode all of the data quality dimensions because the completeness of coverage changes over time, thus affecting the comparability and accuracy of the resulting estimates.

Registers of farms based on administrative sources such as business registrations or tax collections. This process is used in some developed countries. It offers the advantages of the registers from the agricultural census, but again, needs to be updated regularly. A disadvantage of the administrative sources is that they may not include the total population, especially units

below a threshold required to be registered or pay taxes. In other words, while they will be inclusive of commercial farms, they are not likely to include small scale farms, and subsistence farming units.

Area Sample Frames. An area sample frame is the land mass of the country or the space within a country containing the populations of interest. Both maps and satellite images are used to divide the country into administrative areas such as provinces districts, etc. Satellite imagery can be used to subdivide the administrative areas into land use categories such as cropland, rangeland, woodlands, urban areas, etc. Sampling units of segments of land with identifiable boundaries can be formed, or each land use stratum can be divided into square grids and a sample of points becoming the sampling units. During the data collection process, rules of association are used to connect farm holdings or households to the segments or points. An area frame is suitable for obtaining information about variables associated with land such as crops, livestock, forests, and water. Depending on the process used, area frames can be costly and time consuming to construct. However, recent innovations using satellite imagery and two-stage sampling of points have reduced both the cost and time. An advantage of an area frame is that the frame does not go out of date, it is complete in its coverage, and provides a basis to geo reference survey data with the underlying land use. It also provides ground truth useful for classifying satellite imagery by land cover. The primary disadvantage of area frames is that the sampling is based on land use and not the size and type of agricultural holding. Sampling variability becomes a problem if there is a large range in size of the agricultural holdings. A summary of the methodology of area frame sampling is provided by Gallego. Another disadvantage is that data collection costs exceed those based on registers where telephone or mail can be used instead of personal interviews.

Multiple Frames. A combination of the above frames is used, often involving the use of an area frame in conjunction with one of the list frames to take advantage of the strengths and weaknesses of each. The FAO provides an overview of multiple frame sampling. This is an appropriate where there is a large variation in the sizes and types of agricultural holdings with a subset of large commercial farms. The list of commercial farms can be stratified by size and type, and the area frame ensures the population is completely covered by providing coverage of the small and subsistence farms.

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