AGRICULTURAL STATISTICS

Training programme

IMPORTANCE OF AGRICULTURE & Agriculture Today

Agriculture

Agriculture plays a crucial role in the economy of developing countries, and provides the main source of food, income and employment to their rural populations. Improvements in agriculture and land use are fundamental to achieving food security, poverty alleviation and overall sustainable development.

Agriculture is an important user of the agrometeorological information(to study the influence of metrological conditions upon growth and development of field, fruit and other crops). Its turning to good account combined with other types of specialized information (agricultural, technological, economic, etc.) being achieved in order to prevent and reduce the meteorological risk in agriculture, as well as to establish sustainable development strategies.

Sectors of Agriculture

- Agriculture sector is mainly divided into the following four sub-sectors:
 - i. Crops
 - ii. Livestock
 - iii. Fishery (Aquaculture)
 - iv. Forestry (Silviculture)
- Agricultural sector covers the activities related to:
 - > Growing crops, fruits & vegetables
 - > Harvesting & Threshing
 - Growing of trees & logging
 - Fishing & Breeding
 - > Rearing of animals and poultry
 - Production of milk, eggs etc.

Crops

Crops sub sector cover the activities of growing crops, fruits and vegetables, harvesting and threshing, growing of trees and logging.

Livestock

The livestock sub-sector includes the value of livestock products and the value of draught power.

The sub-sector has been divided in to the following broad categories.

i) Net sale of animals (for slaughtering)

ii) Natural growth of animals

iii) Livestock Products

a) Milk Production
b) Draught Power
c) Dung and Urine
d) Wool and Hairs
iv) Poultry Products

Fishery

The fishery sub sector covers commercial and subsistence fishing in ocean, coastal and offshore waters and inland waters. This includes catching, tackling and gathering of fish from

rivers, canals, lakes, fish farms, ponds and inundated tracts.

Forestry

The forestry sub-sector covers the activities of logging and gathering of uncultivated forest products which are classified into two groups.

i) **Major products** comprising industrial wood such as timber & firewood; and

ii) **Minor products** include a large number of heterogeneous items such as ephedra, grazing fodder, resin, medicinal herbs etc.

Importance of Agriculture

Agriculture

- Is the hub of agrarian economy
 - > Is a key Economic Driver. It is central to
 - >Individual livelihood
 - Poverty Alleviation
 - Nations "Economic" growth, e.g. agriculture contributes

20.9 % of GDP of Pakistan.

- > Is key to Healthy Biosphere as it provides nutrition which is key determinant of human health.
- Provider of energy -fuel-wood and medicinal plants
- Practices play a critical role in either destroying, maintaining or developing biodiversity-ecological services which are critical for sustainable



Since Agriculture is a land based economic activity therefore agriculture statistics cover Land Used Statistics (LUS). Crop area statistics is a major segment of LUS.

Agriculture Today

- Agriculture is now a days converting into agro based and agro industry economy. Many countries in the world are getting primary/raw products much cheaper from under developed countries and after value adding they are selling agro products on much higher prices.
 - Rural growth is widely shared, with private and competitive agriculture and agribusiness as the main engine of growth. Investments in agriculture therefore achieve a strong multiplier effect which stimulates rural and urban economies alike. The historical take-off of newly industrialized economies on high growth trajectories was usually preceded by a phase of vigorous agricultural growth.

- The food and fibers that sustains the entire population of this planet is produced just on 3% of the planet land. 97% of the land area is not crop or grazing land.
- Of the 800-900 million undernourished people in the world, the majority is living in rural areas.
- In developing countries agricultural decisions are taken by the small farmers based on the local level market information. This is in spite of the fact that in the process of economic liberalization and globalizations, agricultural markets in many countries have been linked, integrated and influenced by the global market. Thus, empirical evidences show that the individual farmer decisions are not helpful in managing their economic efficiency and profitability without information on production and marketing in their own countries as well as of the international market. So there is a need of "A gricultural Marketing Information

While a growing use of grain as feedstock for biofuels could boost food prices beyond current levels, the trend could also "exert additional stress on already highly exploited land and water resources worldwide." (IMF, 2007)

Increasing biofuel production to a point where it provided 5% of global fuel needs by 2015 would require expanding the acreage of <u>all</u> cultivated land worldwide by <u>15%</u> (LMC International, 2006)

- Half of all poor people live in the driest areas of the world. By 2025, 1.8 billion people will be living in areas with absolute water scarcity, and two-thirds of the world's population could be living under water stress conditions (FAO, 2007).
- The current expansion of the agricultural frontier puts additional pressures on available water resources beyond the carrying capacity of regional ecosystems.
- water scarcity can be found in farming-related techniques harvesting more rainfall, reducing waste in irrigation, increasing crop productivity, and in changing crop and dietary choices (FAO, 2007).

- The higher education sector is playing an increasingly important role in world's Agricultural Research & Development.
- > Theoretical and practical trainings in various departments at national and international level around the world has been carried out by scientists, extension workers and progressive farmers.
- According to the World Bank, growth in agriculture is twice as effective in reducing poverty as growth in other sectors.

- > Almost 50% of labor force is generated through agriculture.
- Food production is dependent upon agricultural resources mainly land and water resources, but intensive cultivation, increased use of fertilizer, pesticide, conventional soil management practices and improper use of irrigation water resulted in deterioration of land and water resources leading to poor crop yield.
- Large fertile areas fell prey to water logging and salinity making farmers more food insecure.

% Share of Agriculture In Economy

China, USA, India, Brazil, France are among the key players for the major

agricultural share in economy.

These 5 countries account for:

- 50% of world's GDP
- 40% of world's agricultural GDP
- 65% of world's agricultural population
- 50% of world's food production (calories)
- 50% of word's food consumption (calories)
- 40% of world's agricultural exports
- 40% of world agricultural imports

Major Agrarian Economies % Share of Agriculture in GDP

COUNTRY	YEAR	% SHARE OF AGRICULTURE IN GDP
USA	2010	1.2
	2008	1
UK	2010	0.9
	2008	1.0
EGYPT	2010	10
	2008	13
KENYA	2010	19
	2008	21
FRANCE	2010	2.1
	2008	0.1
BRAZIL	2010	6
	2008	6

Major Agrarian Economies in Asia

of Agricultu	re in GDP
YEAR	% SHARE OF AGRICULTURE IN GDP
2010	22
2008	20
2010	10
	Agricultu YEAR 2010 2008 2010

PAKISIAN	2008	20
	2010	10
CHINA	2008	11
	2010	16
INDIA	2008	18
	2010	16
INDONESIA	2008	15
	2010	14
SRILANKA	2008	13

World wide Comparison of % Share of Agriculture in Economy

- Agriculture represents about 30% of GDP in Africa and South Asia; about 20% in East Asia & Pacific; and about 10% in Central Asia, Latin America & Caribbean.
- The 1980-1993 agricultural growth rate was about 4% in Middle East & North Africa, and East Asia & Pacific; about 3% in South Asia, about 2% in Latin America & Caribbean and Africa; and negative in Central Asia.
- Agricultural products account for 30% of exports in Africa, Latin America & Caribbean; about 20% in South Asia and East Asia & Pacific; and 5% in Middle East & North Africa.

Group Work

- What is the role of agriculture in national economy?
- How do you feel agriculture has wide role in food security?
- Evaluate the contribution of subsectors of agriculture in development of country.

AGRICULTURE STATISTICS: CONCEPTS AND DEFINITIONS &

Classification

Agricultural Statistics

- > Agricultural statistics play an important role in country's sustainable development.
- Conventionally it was believed that agricultural statistics revolves around crop statistics.

Main parameters of agricultural statistics regarding crop are:

Crop area, Production, Yield
 But now agricultural statistics cover statistics relating
 Crops , live stock, fishery, forestry.

Purpose & Objective of Agricultural Statistics

- To provide comprehensive knowledge of the basic information of agriculture , rural areas and the farmers.
- To provide the scientific basis for the study of the development of economic and social development, planning and decision making.
- To provide statistical information services to the planners, scholars and public.

Importance of Agricultural Statistics

Agricultural statistics :

- > Is of prime importance for agricultural industry.
- > Is an integral component of National Statistical System.
- > are important in designing development policies in the agricultural sector and the national economy at large. However, there are a number of constraints plaguing the designation of the organization that should be in charge of producing such statistics.
- > Ascertain the crop production, crop yield, qualities of crop produced.
- Furnish information about different operations and different methods which can be adopted for improving crop output.
- Helps to compare the different yields of crops and quality check of crops.

Concepts & Definitions

<u>CROPS</u>

There are mainly two types of crops :

> Major Crops

refers to a crop grown on more than 300,000 acres, for which the pesticide use pattern is so limited that revenues from the expected sales will be less than the cost of registering the pesticide.

> Minor Crops

refers to a crop grown on fewer than 300,000 acres.

- > Main Product (It includes all production of crop expect husk etc.).
- > **By Product** (It includes glumes and all types of husk).

Minor and major crops are further subdivided into seasonal crops:

> Kharif Crops

refers to the crops , for which the sowing season begins in April-June and harvested during October-December.

Rabi Crops

refers to the crops , for which the sowing season begins in October-December and harvested during April-May. Classification of crops w.r.t duration: Temporary Crops

Temporary crops is all land used for crops with a less than one-year growing cycle and which must be newly sown or planted for further production after the harvest.

> Permanent Crops

Permanent crops is the land cultivated with long-term crops which do not have to be replanted for several years, land under trees and shrubs producing flowers, such as roses and jasmine; and nurseries.

Classification of Meadows and Pastures

> Temporary Meadows and Pastures

It is the land temporarily cultivated with herbaceous forage crops for mowing or pasture. A period of less than five years is used to differentiate between temporary and permanent meadows.

Permanent Meadows and Pastures
Permanent meadows and pastures = Permanent meadows and pastures - Cultivated (more than 5 years) + Permanent meadows and pastures - Naturally grown.

Area can be defined in following ways:

> Area Sown

refers to the area on which sowing or planting has been carried out, for the crop under consideration, on the soil prepared for that purpose.

> Land Area

refers to Total land area excluding area under inland water bodies.. Land Area = Agricultural Area + Forest Area + Other wooded land + Other Land

Agricultural Area

Agricultural Area = Arable land and Permanent crops + Permanent meadows and pastures.

> Arable Land

Arable Land = Temporary crops + Temporary meadows & pastures+ Fallow land (temporary: less than 5 years).

Other Land

is the land not classified as Agricultural land, Forest area and Other wooded land. It includes built-up and related land, barren land etc. Production quantity of Primary Crops

refer to the actual harvested production from the field or orchard and gardens, excluding harvesting and threshing losses and that part of crop not harvested for any reason.

> Area Harvested

refer to the area from which a crop is gathered. Area harvested, therefore, excludes the area from which, although sown or planted, there was no harvest due to damage, failure, etc.

Agricultural Area Irrigated
 Agricultural area irrigated = Temporary crops irrigated +
 Temporary meadows and pastures irrigated +
 Permanent crops irrigated + Permanent meadows & pastures (Cultivated and irrigated).

LIVESTOCK

Number of Live Animals

This variable indicates the number of animals of the species present in the country at the time of enumeration. It includes animals raised either for draft purposes or for meat, eggs and dairy production or kept for breeding.

Milk Production

Milk production figures refer to the Net Production (Milk actually milked - milk sucked by young animals + the amount of milk fed to livestock).
 Eggs Production

Egg production refers to the total production of eggs in the shell, and covers also eggs intended to be used for hatching but excludes waste on farms.

FISHERY

Fish Production

It includes both **capture** and **aquaculture** production of fish, aquatic mammals, plants and other aquatic animals, taken for commercial, industrial, recreational and subsistence purposes from inland, brackish and marine waters.

Capture

Data refer to all industrial, artisanal and subsistence fisheries, excluding aquaculture. It should also exclude data on discards.

> Aquaculture

Aquaculture is the farming of aquatic organisms: fish, mollusks, crustaceans, aquatic plants, crocodiles, alligators, turtles, and amphibians. Farming implies some form of intervention in the rearing process to enhance

FORESTRY

Forest Area

is the land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds.

> Other Wooded Land

is the land spanning more than 0.005 km (0.5 hectares); with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these thresholds; or with a combined cover of shrubs, bushes and trees above 10 percent.



International Standard industrial classification (ISIC) According to International Standard Industrial Classification (ISIC), Agricultural Sector classification is divided into three divisions:

- 01 (Crop and Animal production, Hunting and related service activities)
- O2 (Forestry and Logging)
- 03 (Fishing and Aquaculture)

- Division 01 further divided into following seven groups:
 - 011 (Growing of non-perennial crops)
 - 012 (Growing of perennial crops)
 - 013 (Plant propagation)
 - 014 (Animal production)
 - **015** (Mixed farming)
 - 016 (Support activities to agriculture and postharvest crop activities)
 - 017 (Hunting, trapping and related service activities).
- Division **02** further divided into following four groups:
 - 021 (Silviculture and other forestry activities)
 - **022** (Logging)
 - **023** (Gathering of non-wood forest products)
 - 024 (Support services to forestry)

- Division 03 further divided into following two groups:
 - **031** (Fishing)
- 032 (Aquaculture) These classes further divided into different Subclasses and get
 up to the five digit code
 <u>5 Digits ISIC</u>
 WCA Classification

STATISTICAL METHODS AND OFFICIAL AGRICULTURAL STATISTICS

> Input-output structure; Agricultural Crops
Statistical Methods

Statistical methods used for estimations and forecasting of

agriculture statistics are as under:

- Census and surveys in the specialized area of interest.
- Remote Sensing and GIS Technology
- Agro metrological Techniques
- Remote sensing and Agro metrology are newer technologies
- in the field of agricultural statistics.

Remote Sensing and GIS Technology Remote sensing and GIS technology is an advance technology to estimate crop area, yield and land use statistics. By adopting this technology, we can get more precise and reliable estimates of area as compared to traditional method of gardwari which is full of incorrect data. In future, remote sensing and GIS technology has a great potential to improve the quality of area and production statistics of country.



Developing Area Sample Frame

Area sample frame is developed by areal photography by satellite and GIS technology. Then images of area can be prepared. Thereafter area of district is stratified according to land use and crops, identified by using different colors. **Production Estimates**

Production estimates are developed by using:

- i. Metrological Data
- ii. Remote Sensing Data
- iii. GIS Approach.

The metrological data is then processed and analyzed with Ms. Excel. Graphs and diagrams(ombrothermic diagram) will be formulated thereafter.



Ombrothermic Diagram is a two axis graph showing average temperature and rainfall. Temperature is represented by a curve and rainfall with histogram.

Remote sensing data can be used :

- i. To estimate agro metrological variable(actual evaporation, bio mass, soil moisture.
- ii. As input in crop growth simulation model.
- iii. Time series of remote sensing can be used for crop growth monitoring.

Agro metrological Techniques

Agro metrology is the science which studies the influence of metrological conditions upon the growth and development of field, fruit and other crops, aiming at determining the needs of Agricultural system or biotope in reaching the optimal biological productivity.

Official Agriculture Statistics

- In Pakistan official agriculture statistics is collected through the following process.
- CRS (Crop reporting Services) department of the provinces compile the major agriculture statistics at District level and consolidate these at provincial level. These departments collect the data through :
 - Potwar Circles
 - > Survey Estimation

CRS of the provinces forward the consolidated statistics at provincial level to the central statistical office, where the validity and reliability of these provincial statistics is verified. Then these provincial statistics are compiled to get estimates at national level which thereafter are forwarded to the Ministry of food, Agriculture and Livestock (MINFAL) for release.

In-Put Structure of Agriculture Sector



Input of Crops

- The input of crops, mainly derived from Agriculture sector is :
- > Seeds, Fertilizer
- Pesticides, Insecticides
- > Water Cost of sowing
- > Ploughing

% Share of Input regarding Major/Minor Crops in Agriculture

Sector

S.No	Input of major crops	% share in input		S.No	Input of minor crops	% shar in inpu
1	Seed	20.23	1	1	Seed	13.42
2	Fertilizer	44.79		2	Fertilizer	51.14
3	Pesticides	5.46	l	3	Pesticides	5.95
4	Water	10.03		4	Water	12.84
5	Ploughing& Planking	16.29		5	Ploughing& Planking	13.06
6	Transport charges	0.83		6	Transport charges	0.88
7	Wastage	2.36		7	Wastage	2.72

% Share of Input regarding Production and Area of Minor crops

S.No	Production of Minor crops	% share in input
1	Pulses	0.30
2	Vegetables	9.13
3	Fruits	10.24
4	Condiments	2.95
5	Oilseeds	0.58
6	Other crops	76.80

S.No	Area of Minor crops	% share in input
1	Pulses	7.9
2	Vegetables	8.2
3	Fruits	17.7
4	Condiments	4.8
5	Oilseeds	9.1
6	Other crops	52.2

Input of Livestock

The input of livestock, mainly derived from Agriculture sector is:

Fodder Medical care Transportation
Interest Value of Chick
Poultry Feed

% Share of Input regarding Live stock in Agriculture sector

S.No	Input for Poultry	% share
1	Fodder	64.98
2	Input for Poultry	11.66
3	Other Input	23.36

Input of Fishery

The input of fishery, mainly derived from Agriculture sector is :

- > Fish seed Fertilizer
- Fodder Water Charges
- Farm implements Transportation

% Share of Input regarding Fishing

S.No	Input	% share in input
1	MARINE FISH	36
2	INLAND FISH	16

Input of Forestry

The input of forestry, mainly derived from Agriculture sector is :

> Seed

- > Plantation Fertilizer
- > Pesticides Weeding

Percentage share of input for forestry has been taken as 25% of the total output of the forestry ,on the basis of study conducted in 1999-00.

Output Structure of Agriculture Sector



Output of Crops

The output of crops, mainly derived from Agriculture sector is :

> Products

> By Products of crops

% Share of Output regarding Production and Area of Major

crops

S.No	Major Crops	% share in Production
1	Wheat	26.0
2	Rice	7.5
3	Cotton	6.5
4	Sugarcane	54.2
5	Bajra	0.3
6	jowar	0.2
7	Maize	3.9
8	Seeamum	0.04
9	Gram	0.8
10	Barely	0.1
11	R/Mustard	0.2
12	Tobacco	0.1

S.No	Major Crops	% share in Area
1	Wheat	47.16
2	Rice	15.44
3	Cotton	14.70
4	Sugarcane	5.37
5	Bajra	2.45
6	jowar	1.37
7	Maize	5.48
8	Seeamum	0.47
9	Gram	5.63
10	Barely	0.45
11	R/Mustard	1.22
12	Tobacco	0.26

Output of Livestock

The output of livestock, mainly derived from Agriculture sector is :

- > Milk
- > Draught power
- > Wool & Hairs
- > Dung & Urine

% Share of Output regarding Live stock

S.No	Out put of Livestock	% Share
1	Net Sales	25.46
2	Natural Growth	6.63
3	Livestock Products	59.29
4	Poultry Products	8.62

Output of Fishery

The output of fishery, mainly derived from Agriculture sector is:

> Quantity & Value> By Species

% Share of Output regarding Fishing

S.No	output	% share in output
1	MARINE FISH	72.21
2	INLAND FISH	27.79

Output of Forestry

The output of forestry, mainly derived from Agriculture sector is : >Timber >Firewood >Resin >Grazing >Medical herbs etc.

% Share of Output regarding Forestry

S.No	output	% share in output
1	Timber	9.03
2	Firewood	83.14
3	Other Products	7.8

DATA COLLECTION SCHEMES &

Concept of Survey Sampling

Sample Design & Sampling Frame

• Sample Design:

In sample studies, we have to make a plan regarding the size of the sample, selection of the sample, collection of the sample data and preparation of the final results based on the sample study. The whole procedure involved is called sample design.

Sampling Frame:

A complete list of all the units of the population is called the sampling frame. A unit of population is a relative term. The sampling frame contains all the units of the population. It is to be defined clearly as to which units are to be included in the frame. The frame provides a base for the selection of sample.



Data Collection Schemes

Mainly there are two types of data collection schemes:

> Census

Sample Survey

Census is complete count. In a census, each unit (such as person, household or holding) is enumerated.

For example, <u>census of agriculture</u> is a statistical operation for collecting, processing and disseminating data on the structure of agriculture, covering the whole or significant part of the country.

Sample Survey: If it is not essential to conduct the complete enumeration, then a sample of some suitable size is selected from the population and the study is carried out on the sample. This study is called sample survey.

For example, In an <u>agricultural production sample</u> <u>survey</u>, a sample of agricultural holdings is enumerated, and information from the sample holdings is used to

Concept of Survey Sampling

Survey Sampling describes the process of selecting a sample of elements from a target population in order to conduct a survey.

Advantages of Survey Sampling:

Survey Sampling has some advantages over the complete count. These

are:

- Need for Sampling:
- Saves Time and Cost:
- > Reliability
- > Accuracy

Data Collection Schemes for Crop Sector

In Pakistan, data collection scheme for **crop sector** is shown below:



AGRICULTURAL CENSUS AND SURVEYS

World Census for Agriculture (WCA)

Agricultural Census and

- Agricultural census: A census of agriculture is a statistical operation for collecting, processing and disseminating data on the structure of agriculture, covering the whole or a significant part of the country. Agricultural census is conducted after every 10 years.
- **Agricultural surveys:** In the absence of Agricultural census, sample surveys provide information about agriculture sector.

Importance and Needs

- Agricultural census/ surveys are important in the following aspects:
 - Helpful in Monitoring the Millennium Development Goals.
 - · Help the government and others in effective planning and policymaking.
 - Providing baseline data for monitoring agricultural development projects.
 - Providing data for the private sector.
 - Provide benchmark data to meet the demand for small area data.
 - A full enumeration census serves as a sampling frame for intercensual surveys.

Sample Design & Frame For Agricultural Census

In Pakistan, different sample designs are adopted for different parts of the country in view of the varied local conditions and availability of relevant information for selecting a sample. Entire country was divided into three distinct parts for sampling:

- 1) <u>Rural settled areas of provinces</u>. Here three stage weighted and stratified sample are used. These three stages are:
 - <u>First Stage:</u> Selection of Patwar Circles
 - <u>Second Stage:</u> Selection of Mouzas
 - <u>Third Stage:</u> Selection of Cluster of Households



2) <u>Rural settled areas of Balochistan and Azad Jammu</u> <u>& Kashmir</u>; where a single stage weighted sample are used.

In rural settled areas, sample size was determined at sub division level.

3) <u>Rest of the country</u>, comprising entire urban areas and unsettled rural and tribal areas including Northern Areas; where a single stage systematic sampling was used.

In urban areas the sample size varied according to the size of populace in an urban unit.

CENSUS QUESTIONNAIRE

- > The <u>Questionaire</u> used in the census has two versions
- Main questionnaire
- Brief questionnaire
 - Main census questionnaire (consist of eight pages) to be filled-in only for the selected households reporting owned and /or rented-in land.
 - Brief census questionnaire (of two pages) to be filledin for the selected households not reporting any land.

Basic Agricultural Statistics in Census

Pakistan Agricultural Census provide fundamental data on the following:

- · Farm Size
- Land Utilization
- · Irrigation
- · Cropping intensities
- Usage of Fertilizer and insecticide
- · Agricultural Machinery ownership etc.
Sampling Design & Frame For Agricultural surveys

In Pakistan, Province level area and crop checking surveys are conducted

in the following way:

- For Area and Crop checking surveys "Village Master Sample" Scheme is used. District wise Village list along with the area sown to wheat crop for the year (1975-76) has been used as frame.
- Each of district constitute an independent stratum so as to get the independent estimates of area and production at district level.
- Keeping in view the resources available and variability of characteristics, a reasonable number of villages is selected.
- The allocated sample villages have been selected in each of the district by the method of the probability proportional to wheat area of each village sown in year (1975-76) by random/systematic method of selection.

What is WCA?

- WCA is a world-wide programme of agricultural censuses promoted by FAO.
- Over 100 countries participate in the programme.
- WCA is a ten-yearly programme
 - started in 1930
 - > 2000 programme covers 1996-2005
 - now preparing 2010 programme covering 2006-2015

FAO Role in WCA:

- Issues guidelines on data items, concepts, classifications, tables, etc. for countries.
- Provides technical assistance for countries in conducting agricultural censuses.
- Summarizes census data obtained from countries.

Outline of WCA 2010 programme



Strategy for agricultural census component

• <u>Core census module</u>

- Done on complete enumeration or large sample basis.
- Limited data to be included:
 - + key data required by the country
 - + data needed for sampling frames for agricultural surveys
 - + data for international comparisons
 - + data to be finely classified e.g., by administrative units

Census supplementary module(s)

- Collection of more detailed data for sub-samples selected from core census module.
- Countries select topics for census supplementary modules according to needs.

Agricultural census component: recommended minimum items for core module

- identification/location of holding
- type of holding sex of holder \succ
- \succ
- age of holder household size
- main purpose of production
- area of holding according to land use types
- total area of holding
- land tenure types

- presence of temporary crops by type
 - presence of permanent crops by type and whether in compact plantation
- number of animals by livestock type
- presence of aquaculture
- presence of forest trees and other wooded land
- other economic activities
- whether holding is a "farm household"

Agricultural census component: recommended items for sample enumeration

80 proposed items under 12 main headings

- Land (7)
- Water (6)
- Crops (10)
- Livestock (10)
- Agricultural practices (8)
- Agricultural services (10)
- Demography (6)

- Economic activity of household members (4)
- Household food security (6)
- Aquaculture (5)
- Forestry (4)
- Management of the holding (4)

Issues for countries in developing core and supplementary modules

• <u>Core module</u>

- Include recommended minimum set of 16 core items.
- Include additional items from recommended sample items as required for national needs.
- Include additional items needed for sampling frame purposes.

• <u>Supplementary modules</u>

- Select topics for survey(s) from recommended headings and items, according to data needs.
- One survey may cover items from different headings.
- Select sample based on census frame.

Changes in the scope

- Most items in previous programmes will be included in the 2010 round. Some items are included for the first time: Community-level data, Agricultural services...
- Other changes concern concepts and definitions, for instance :
 - agricultural holding: reviewed to ensure consistency with national accounting standards
 - activity status and employment: changed to better reflect the structure of employment in rural areas and to be consistent with ILO standards
- Structured classifications provided for crop type and, for the first time, for livestock type and type of machinery

Coordination of agricultural census and population census

- WCA 2010 encourages countries to coordinate population and agricultural censuses.
- Use of standard concepts and definitions.
- Sharing of operational materials such as maps.
- Use of population census as frame for agricultural census.
- Collecting additional data in the population census to help in
- the agricultural census.
- Coordinating the two data collection operations.
- Linking data from the two censuses.

Strategy for agricultural survey programme

- Agricultural survey programme includes:
- + surveys for current agricultural statistics
 such as crop
 production
- + special in-depth surveys
- Surveys to be done using agricultural census as a frame.
- > Themes to be developed for the survey programme.
- > The need for these surveys to be taken into account in design of core census module.

Issues in past WCA programmes

- High cost and demands on technical and other resources.
- How to satisfy demand for more data, such as food security and gender.
- Complexity of topics such as food security, and difficulties in collecting these in an agricultural census.
- Need for coordination with population census.
- Need for integration of agricultural census with current agricultural statistics.
- Whether agricultural census should cover agricultural holdings or all rural households.
- Statistical terminology in "censuses" based on sample enumeration.

Advantages of the WCA 2010 approach

Previous problems

High cost and demands on resources.

- Difficulty meeting demands for more data.
- Complexity of some census topics.
- Coordination with population census.
- Integration with agricultural statistics programme.
- Inclusion of all rural

<u>WCA 2010</u>

- Modular approach: small core module plus sample modules.
- Can collect more data through use of sampling.
- Cover in more depth in supplementary modules.
- Guidelines for coordination provided.
- Census and survey development integrated.
- Option provided to expand scope.

ESTIMATION AND FORECASTING & Crop Estimation

ESTIMATION

Definition:

Estimation is the calculated approximation of a result which is usable even if input data may be incomplete or uncertain e.g. we can use area and per hectare crop production to estimate over all crops production.

CROPS ESTIMATION

Crops estimation is derived from:

1) Acreage Estimates

2) Production Estimates

Sample Surveys for Crop Estimation

Various surveys conducted for acreage and production estimation in crop Sector are:

- Area sample survey (Acreage Survey)
- Crop cutting surveys
- Opinion surveys
- In some areas, subjective judgment is used for acreage estimate.

Methodology of Acreage Survey (Girdwari)

This survey is carried out in all randomly selected sample villages. The crop reporter conduct the field to field crop inspection (Girdwari) twice during the season: once at the beginning of the season indicating method of sowing i.e. line/ broadcast and second before harvest indicating the varieties sown. Beside these, a special crop inspection (Girdwari) is also carried out to assess area under horticultural products.

Example

Statistical Model for Wheat Crop Estimation in Punjab

- In order to estimate the yield per acre of wheat crop, an area frame is prepared which includes all the wheat growing fields in sample villages and in each village, three fields (each field has two plots=six plots) measuring (20 ft x 15ft) are randomly located through a very scientific method. The crops of these plots are harvested by the technical staff when the crop is fully matured. The produce of the plots is threshed, winnowed, cleaned and weighted carefully.
 - The yield obtained from the yield estimation surveys are used to arrive at the average yield per acre. This method is used for the final estimation but for the second estimate, the data of grower opinion survey, climatic conditions, input availability and forecast reports given by the regional statisticians are used as base.

ACREAGE ESTIMATION

In Pakistan, the first and second estimates of area sown under 12 major crops arrived at through Sample Surveys undertaken by the Directorate of Agriculture, Crop Reporting Service departments of the provinces. The final estimates of area sown under all crops are based on coordination of sample survey estimates and complete enumeration (Girdawari) of all Mouzas carried out by Patwaris of Revenue Department twice a year. The final acreage estimates are approved by the Provincial Agriculture Statistics Coordination Board. This information is then passed on to Central Statistical Office (CSO), where the provincial level estimates are compiled to get estimates at National level.

The CSO used to release three estimates of crops.

- First estimate of crop indicates the tentative area planted under the given crop.
- Second estimate indicates the area and provisional size of production.
- > The Final estimate indicates post harvest estimate and contains firm area and production figures.

For six major crops all three estimates are released. Two estimates of fourteen other important crops are released. For other minor crops only one estimate released.

First Estimate of Wheat Crop

The following table represents the first estimate of wheat crop for 2010-11 which includes only area.

Province	Area "000	% Change	
	2010-11	2009-10	
Punjab	6678.0	6913.5	-3.4
Sindh	1080.9	1092.3	-1.0
K.P	725.0	758.3	-4.4
Balochistan	321.1	367.5	-12.6
Pakistan	8805.0	9131.6	-3.6

Second Estimate of Wheat Crop

Province	Area "000" hectares		% change	Production "000" tonnes		% change
	2010- 11	2009- 10		2010- 11	2009- 10	
Punjab	6678.0	6913.5	-3.4	18164. 9	17919. 0	1.4
Sindh	1144.4	1092.3	4.8	4219.9	3703.1	14.0
K.P	740.2	758.3	-2.4	1113.2	1152.5	-3.4
Balochistan	332.4	367.5	-9.6	715.5	536.2	33.4
Pakistan	8895.0	9131.6	-2.6	24213. 5	23310. 8	3.9

 Above table represents the first & second estimates of wheat crop for 2010-11 which includes area and production.

> Work on the final estimate of wheat crop is in progress.

PRODUCTION ESTIMATION

In Pakistan, Preliminary production estimates of 12 major crops are based on opinion survey undertaken by the Crop Reporting Service Departments. For the final yield estimates, cropcutting surveys are conducted by the Crop Reporting Service for wheat, cotton and rice, Grower's opinion surveys are used for other crops.

Estimation Formula:

Production of crops =

Total area under crops * Production per hector

The final production estimates of major crops are also approved by Provincial Agriculture Statistics Coordination Board.

FORECASTING

Definition Forecast :

"is an estimate of something future" "is a statement of what may happen based upon present conditions and observations interpreted in the light of previous experience". Example:

For forecasting wheat production per hectare most important variables can be: 1) lagged output 2) labor force 3) use of tractors 4) sum of the rainfall in the months of November to March

AGRICULTURE IS MUCH LESS PREDICTABLE AND CONTROLLABLE THAN OTHER SECTORS

>Prediction is the sum total of the consequences of the decisions taken by millions of farmers operating across the country in diverse conditions and driven by their own limitations, constraints, perceptions and response mechanisms making estimation a complex process.

>Major role played by nature, predominantly the weather in deciding production (unforeseen flood or a drought, untimely rain, a dry spell, temperature nuances, a hailstorm or a pest infestation).

BENEFICIARIES

- Farmers (decide their asking prices, their inventory and marketing plans)
- Traders (for planning their logistics, inventories and contracts),
- Crop Insurance Companies (assessment and provisioning).
- Banks (organizing their credit)
- Exporters and Importers (plan contracts)
- Processors (plan capacity, manpower and marketing strategy),
- Input Suppliers (production, inventory and marketing plans during the course of growing season)
- Government is a prime beneficiary of efficient forecasting which provides in advance a picture of the economic well-being of the country, the government (policy planning and initiate operations before the onset of a possible crisis).

IMPORTANCE OF FORECASTS OF AGRICULTURAL PRODUCTION

- Forecasts of agricultural production is important in an economic system in which the players are motivated to take conscious decisions. The ability to forecast production levels in agriculture helps economic players in nearly all sectors to plan their activities in an informed way.
- The prosperity of the farm sector is an important determinant of the performance of the economy at large.
- Projections of agricultural production are important for projecting the national and state domestic products.
- The farmers' ability to predict rationally is always known to depend on their ability to anticipate the future.
- Number of important business decision could be effected by the forecast such as Production schedules , Raw material,

Cont...

- Crop yield forecasts are extremely useful in formulation of policies regarding stock distribution and supply of production to different areas in the country.
- Losses due to crop pests and diseases can be reduced if their occurrence is known in advance so that timely remedial measures can be taken.
- Early and reasonably accurate forecasts are crucial to a government in making policies in an open market situation.

Resources Available For Forecasting

- Historical data which is being forecasted.
- Historical data on the factors effecting the data being forecasted
- Knowledge and better understanding of historical data.

Forecasting Methods in Agriculture Sector

Forecasting methods in Agriculture sector are divided into following categories:

Quantitative Forecasting MethodsAgro metrological Forecasting Methods

Quantitative Forecasting Methods

Two major categories of quantitative forecasting methods are:

- **Reliance Method**: Reliance or time series method relies on the use of past data of variable that is being forecasted.
- **Casual Method** : It also uses historical data but forecasting is predicted on the cause and effect relationship between the variable being forecasted and the other selected elements.

TIME SERIES Models for Forecasting

Forecasting of crops area and production can be done through time series models i.e. * Autoregressive (AR) model *Moving average (MA) model *Autoregressive Moving average (ARMA) model *Autoregressive Integrated Moving average

(ARIMA) model

Agro Metrological Methods for Forecasting

Agro meteorological crop yield forecasting (ACYF) methods provide a quantitative estimate of the expected crop yield over a given area, in advance of the harvest and in a way that constitutes an improvement over trends provided no extreme conditions occur. They are based on the commonsense assumption that weather conditions are the main factor behind the inter-annual (short-term) variations of detrended crop yield series. Agro metrological methods are of two types.

- Descriptive methods
- Regression methods

Descriptive Methods

Descriptive methods are non-parametric. It is sufficient to identify the environmental (agro meteorological) variables that are relevant for the crop under consideration. This is normally done with statistical clustering analysis on a combination of time-series and cross-sectional data. Once the groups have been identified, it must be verified that yield averages corresponding to different clusters significantly differ from each other.

One of the reasons why simple descriptive methods can be very powerful is that climate variables do not vary independently and constitute a "complex". For instance, low cloudiness is associated with high solar radiation, low rainfall, high minimum temperatures and low minimum temperatures. Each of the variables affects crops in a specific way, but since they are correlated, there is also a typical combined effect, which the nonanalytical descriptive methods can capture.

Regression Methods

The simplest regression techniques rely on regression equations (mostly linear) between crop yield and one or more agro metrological variables, for instance

Yield (Tones/Ha) = 5+0.03 *March rainfall (mm) - 0.10 * June temperature (0 C).

Beyond their simplicity, their main advantage is the fact that calculations can be done manually, and the data requirements are limited. The main disadvantages lie in the fact that they perform very poorly outside the range of values for which they have been calibrated. They often also lead to unrealistic forecasts when care is not taken to give greater priority to the agronomic significance than to statistical significance. The equation above, for instance, suggests that low march rainfall (a negative factor) could be corrected by below zero temperatures in June (frost), which obviously does not make sense. Another disadvantage is connected with the need to derive a series of equations to be used in sequence as the cropping season develops.

Forecasting Wheat Production in Pakistan

A study proposes the following specification of the production function of wheat:

 $lnYt = \beta 1 + \beta 2lnLt + \beta 3Tt + \beta 4lnFt + \beta 5lnR1t + \beta 6lnR2t + \beta 7lnSRt + \beta 8lnYt - 1 + ui$

where

- Yt = Wheat output per hectare
- Lt = Labor force per hectare
- Tt = Number of tractors per hectare
- Ft = Fertilizer use per hectare

R1t = Weighted average of rainfall in the Months of November, December, January, February and March

R2t = Weighted average of rainfall in the Month of April

SRt = Weighted standard deviation of rainfall in the Months of

November, December, January, February, and March.

Yt-1 = Lagged output per hectare



To evaluate the ability of the model to accurately forecast wheat

output, the entire analysis was conducted using the time period 1979 to 2004, making forecasts for the years 2005 and 2006. These forecasts were then compared with the actual values of wheat output realized in 2005 and 2006 to assess the quality of forecasts.
AGRICULTURE GROWTH AND PRODUCTION INDEX

Agriculture GVA

Production / Quantum Index

Formula for production/quantum index: Quantum index = Σqn *100 $\Sigma q0$

Where : qn is current year production.
qo is base year production.
> Base year for quantum index in Pakistan is 2005-06.

Quantum Index Number of Main Agriculture

(rons									
	Production '00	0' tonnes	Quantum Index						
Crops	2005-06	2009-10	2005-06	2009-10					
FOOD CROPS	<u>30874.1</u>	<u>34535.0</u>	<u>100</u>	<u>111.9</u>					
Rice	5547.2	6882.7	100	124.1					
Wheat	21276.9	23310.8	100	109.6					
Barley	87.5	71.4	100	81.6					
Jowar	152.6	154.1	100	101.0					
Bajra	220.8	293.0	100	132.7					
Maize	3109.6	3261.5	100	104.9					
Gram	479.5	561.5	100	117.1					
FIBER CROPS	<u>2214.5</u>	<u>2196.5</u>	<u>100</u>	<u>99.2</u>					
OTHER CROPS	<u>44984.9</u>	<u>49676.1</u>	<u>100</u>	<u>110.4</u>					
Sugarcane	44665.5	49372.9	100	110.5					
Rape & Mustard*	171.7	150.5	100	87.7					
Sesamum	35.1	33.4	100	95.2					
Tobacco	112.6	119.3	100	106.0					

AGRICULTURE CROPS

Major crops:



Rice, Wheat, Cotton, Sugarcane, Gram, Maize, etc.

Minor crops:

Pulses, Vegetables, Fruits, Oil seeds, Condiments, etc.

Intermediate **Consumption:**



Seeds, Fertilizer, Pesticides, Water, Transport Charges, etc.

Sources:



Provincial Agriculture & Irrigation Departments, IRSA, WAPDA, Federal Directorate of Fertilizer, Pesticides Association, etc.

Gross Value Added:



Value of output including by-products (minus) Intermediate consumption

GVA of Major Crops

- Data required: Area ,production, base year prices
- <u>Evaluating total output</u> at constant prices by multiplying the production with base year price and dividing by 1000 to make the output in millions.
- > <u>Evaluating intermediate consumption:</u>
- Seed : total area sown ,average use of seed / per hector (base year), average use of seed (M.tons), Average price of seed/M.tons
- > Total use of seed=total area * average use of seed
- > Total use of seed is multiplied with the base year price and dividing by 1000,000 to get it in "000" rupees

<u>Fertilizer</u>: Take the value of fertilizer used in the given year, multiplying it with the base year value ratio w.r.t Major or Minor

crop.

Year	Quantity"000"N.TO N	Value of total fertilizer	Value of Fert. Major Crop	Value of Fert Minor Crop
1999-00	2833	49029	36953	12076
2008-09	3711	64215	48398.80	15816

Value of total fertilizer for the given year 2008-09

- =(Value of the base year * Quantity of the given year) / Quantity of the base year
- *Quantity of the given year multiply with the Base year value and Quantity Ratio
- **Value of the Major Crops** 0.7537 of Total Value

Value of the Minor Crops 0.2463 of Total Value > <u>Pesticides</u>: Take the value of pesticides of the given year, multiplying it with the base year value ratio w.r.t Major or Minor crop.

 \succ <u>Water</u> : Take the value of water of the given year, then multiply it with the base year price.

Ploughing & plunking: The area and base year price of ploughing & plunking.

Transport charges: 0.01 of seed(input) and 0.0125 (Fertilizer and pesticides) input.

➢<u>Wastage</u>: 0.005 of total Gross output value

GVA: Total output –Intermediate consumption.

*** Same is applied for minor crops.

Practical Example: Calculating GVA of Major Crops(2008-09)

GVA of Major Crops for the year 2008-09								Rs.Millio n	
			Input V	7alue (Intern	mediate Consumptic	pn)			
Total Gross Output	Seed	Fertilizer	Pesticides	Water	Ploughing & Planking	Transport charges	Wastage	Input Value	GVA (1-9)
1	2	3	4	5	6	7	8	9	10
510183	21861	48300	5800	10838	17602	807	2551	108048	402135

Calculating GVA for Agriculture Livestock

Composition:



Cattle and their products Poultry and their products

Intermediate **Consumption:** Roughages (green and dry), Concentrates (Grains, Oilcakes), Grass & Grazing, salt, Medicines, etc.

Sources:



Livestock Division, Agriculture Census Organization, Pakistan Poultry Association etc.

Gross Value Added:



Value of output including by-products (minus) Intermediate consumption

GVA Live stock

Output components are

<u>Net Sales</u>
 Take the population of adult animals 3 years of age and above multiply with the
 base year price then with the quarter share determined in the base year

(Net Sales= Sale of Animals (3 years & above) - Purchase of Animals in Livestock Activity)

2) <u>Natural Growth</u>

Take the animals below **one years** of age and multiply with the base year price then with the quarter share determine in the base year

3) Livestock Products

Draught Power: Animal for work multiply with the base year price then with the quarter share determine in the base year

4) Poultry Products

input components Fodder value taken from the crops Green value taken from the crops Dry 0.01377 of live stock products Concentrates 0.25395 of poultry products input for Poultry Other input Transportation, POL, etc. 0.000559 of livestock product Medical care etc. 0.031868 of livestock product Interest (Bank charges) of livestock product 0.02134 0.00431 of livestock product Repair & Maintenance Rent paid (Building, Machinery etc.) 0.000216 of livestock product Value of Chicks of livestock product 0.10775

Practical Example: Calculating GVA of Livestock (2008-09)

GVA of Livestock for 2008-09 on 1999-00 base(Constant)								Rs.Millio n	
Gross output Input									
Net Sales	Natural Growth	Livestock Products	Poultry Products	Total (1+2+3+4)	Fodder	Inputs for Poultry	Other Inputs	Total (6+7+8)	GVA (5-9)
1	2	3	4	5	6	7	8	9	10
194411	50617	452758	65832	763618	93161	16718	33486	143365	620253

Calculating GVA for Agriculture Fishing

Composition: • Marine Inland

Fish, Prawn, Shrimps, crabs, etc. from: Ocean, Coastal and Offshore water, Fish farms, Rivers, Canals, Lakes, Ponds, and inundated tracts, etc.

Intermediate **Consumption:**



Salt, Ice, Fuel & Lubricants, Medicines, Chemicals, etc. and Auction Charges.

Sources:

Marine Fisheries Department, Provincial Fisheries Departments & Federal Bureau of Statistics.

Gross Value Added:



Value of output (minus) Intermediate consumption

GVA for Fishing

OUTPUT COMPONENTS Take the total quantity of fishing marine and inland fishing multiply with the base year price then Less Auction Charges 6.5 % Gross Value of Output Less input 36% **GVA=Total output for the Marine fishing-IC** Under Reporting (100%) Sub-Total Less input 16% GVA=Total output for the inland fishing-IC

Practical Example: Calculating GVA of Fishing (2008-09)

GVA of Fishing for 2008-09 on 1999-00 base(Constant)						
	Total output			Total Input		
Marine Fish	Inland Fish	Total (1+2)	Marine Fish	Inland Fish	Total (4+5)	GVA (3-6)
1	2	3	4	5	6	7
10141	17653	27794	3651	2824	6475	21319

Calculating GVA for Agriculture FORESTRY

Composition:

Timber, Firewood, Ephedra, Grass & Grazing, Resin, Medicinal herbs, and other Minor Forest Products/Output.

Intermediate **Consumption:**



Seeds, plantation, fertilizer, etc.

Sources:

Federal Inspectorate General of Forests. **Provincial Forest Departments.**

Gross Value Added:

Value of output (minus) Intermediate consumption

GVA for Forestry

GVA=Take the value of total output quantity then minus the 24.5 as intermediate consumption

Practical Example: Calculating GVA of Forestry (2008-09)

GVA o	Rs.Million				
Timber	Firewood	Other	Total (1+2+3)	Total Input 24.99% of(1+2)	GVA (4-5)
1	2	3	4	5	6
1653	15225	1435	18313	4218	14095

EMERGING ISSUES

EMERGING ISSUES OF AGRICULTURAL STATISTICS ?

In many developed countries, administrative sources have developed into a standard source in compiling social and economic statistics.

Business and agricultural registers are growing in importance. For agricultural and environmental statistics also remote sensing and GIS are becoming an often used data collection methodology.

Coordination With Other Areas

- Agricultural statistics should not be looked on themselves but be studied in the context of rural development; be placed in a context with the environment, economy etc.
 - To maintain agricultural statistics as part of mainstream statistics, it is needed to link these with environmental statistics: agricultural environmental indicators, rural development, etc.

Approach towards Agriculture Statistics: Sector Wide Approach (SWAP) or Adhoc Approach.

For the developing countries, the agricultural statistics are an essential and basic part of their statistical system. The ad hoc approach focused on only one domain of statistics did not prove to be the most successful approach for the development of sustainable statistical systems in these countries. Therefore SWAP should be adopted.

Globalization trend in Agricultural Statistics

 Globalization is recognized as an important challenge for economic and social statistics. Also in agriculture, the globalization trend is visible in countries specializing in certain crop production and increasing trade flows of agricultural products (and also for example bio fuels) between regions and countries.

Coordination with International Agencies

Compared to other statistics (economic, social), agricultural statistics are relatively far from the direct reach of statisticians at the Central Statistical Offices. As a result the communication and coordination on the international level of agricultural statistics is rather restricted, which needs to be improved.

Brochure

THANK YOU