ANNEX 3 – EXAMPLES FROM DIFFERENT COUNTRIES [1]

3.1 CROP FORECASTING IN CHINA

1 Introduction

China is an agricultural country with a population of 1.2 billion. The Chinese government's basic food policy is to ensure food security on the basis of domestic sources. However, with its huge population and scarce resources, China has suffered increasing environmental restrictions on crop production in recent years. The occurrence of natural disasters in the past years has affected China's food supply. These conditions explain the high priority that is given to an effective crop forecasting system.

The economic structure in China is in the transition period. As a result, agricultural policies change considerably, with both administrative intervention and the free market mechanism playing important roles in agricultural production. Therefore the impact of Government policy and free market indicators need both to be monitored.

2 Organizational set-up

The forecasting system is primarily under the jurisdiction of the Ministry of Agriculture and is implemented by the Market and Economy Information Department, with the assistance of other Departments of the same Ministry. However, the State Statistics Bureau also plays an important role. Generally speaking, MOA relies more on subjective judgement and local sources and SSB on sample surveys. On various technical issues contributions are made by the relevant Organizations, such as the State Meteorological Bureau, Academy of Agricultural Science and the Zhengzhou Mercantile Exchange.

The Ministry of Agriculture (MOA) is forecasting the production of food crops, but also cash crops, livestock products and aquatic products. The main staple food crops are rice, wheat, corn and soybean, which together account for 86 percent of the total crop acreage.

3 Methodology

China's crop forecasting system is very complex. Several different approaches are used and many variables are monitored, including physical and economic factors, as well as Government policy and directives. The Ministry of Agriculture and the State Statistics Bureau are involved in nearly all aspects of crop monitoring and forecasting and it is not clear how much competition and possibly duplication there is. Although objective and technologically advanced methods are used, subjective judgement still plays a big role, especially during the final reconciliation process when results from different methods are compared.

3.1 Agricultural Policy Information

The main sources for agricultural policy information are the State Council, National People's Congress, Ministry of Agriculture, Ministries and Sectors relevant to agriculture and the Local Governments. In addition, policy pronouncements as contained in speeches of high-ranking leaders and relevant agricultural conferences are major sources of agricultural policy information.

3.2 Crop Planting Intention Survey

Information on crop planting intentions comes from the Ministry of Agriculture and the State Statistics Bureau. The State Statistics Bureau, the Market and Economy Information Department of MOA and

[1] These presentations do not necessarily provide a complete description, but highlight the salient points of each forecasting system.

the Crop Planting Administration Department of MOA all have their own independent samples of villages and farmers.

3.3 Crop Monitoring

Information on the crop growth situation and the production prospects is provided by the Ministry of Agriculture and State Statistics Bureau. The information includes crop acreage, growing condition, incidence of pests and diseases, disaster situation and crop weather conditions, among other variables. All these variables are used for a yield and production estimate. The reports are issued at regular interval.

3.4 Agro-meteorological monitoring

Agro-meteorological data is provided by the State Meteorology Bureau. The variables monitored include rainfall, temperature and extreme weather conditions such as drought, cold spells and storms.

An innovative method, described as the clustering method, follows the following steps:
The 30-year meteorological data in six regions are compiled, and the meteorological factors by region, by crop and by month are weighed. On this basis, the weather conditions in the current year and those in the previous years are weighed and clustered so as to identify the year in which the weather conditions were most similar.

3.5 Remote Sensing

Experts from the Chinese Academy of Science (CAS) and the Chinese Academy of Agricultural Science (CAAS) monitor crop conditions by interpreting the multi-spectral data of the satellites of the American NOAA/AVHRR. The Ministry of Agriculture (MOA) has also used some of its results as reference information in predicting crop conditions.

3.6 Agricultural Market Information

Information on government procurement prices of grain comes mainly from the Market and Economic Information Department of MOA; wholesale prices of grain are provided by the Information Centre of MOA and Zhengzhou Grain Wholesale Market. On the other hand, retail prices of grain are sourced from the Price Information Centre of China, while futures prices of grain are taken from Zhengzhou Mercantile Exchange. Import and export data for grains are obtained from the Information Centre of MOA; and grain consumption data from the State Statistics Bureau.

3.7 Other economic factors

The variables monitored include availability of labour, use of farm inputs, availability of credit and last year's producer prices for the crops under consideration as well as alternative crops that farmers can grow, based on the perceived profitability.

3.8 Questionnaires for agricultural experts

Beginning in 1997, the Information Centre of MOA has sent questionnaires three times a year to agricultural experts for the purpose of forecasting sown acreage and production of the main crops. Respondents are those with substantive experience in agriculture, including experts, scholars, department leaders and grassroots staff. Questions are mainly qualitative. The questionnaires are processed quickly and there is much exchange of information. The system will be developed as an e-mail inquiry in future.

3.9 Econometric model

By the end of 1996, as required by the Minister of MOA, a mathematical model for crop production forecasting was introduced. The Information Centre of the Ministry of Agriculture (MOA) has developed an economic model for short-term crop production forecasting. Its main features and methods are shown below:

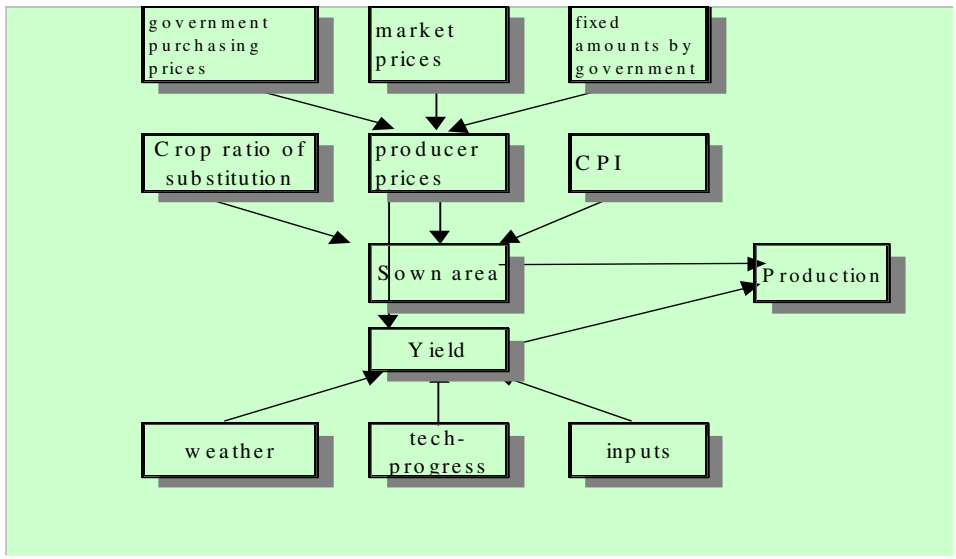
- On the basis of administrative regions, weather conditions and crop planting areas, the country is divided into six different regions, which serve as the basic units for crop forecasting. The major parameters used in the model are also determined by each region.
- Policies, inputs, market prices, weather conditions and technological progress are the major factors for the model forecasting.

4 Integration of forecasts by various methodologies

Every year before the harvest season, MOA invites experts from other ministries, commission departments and research institutes for a consultation in Beijing, where a forecast of the crop production is made. The various forecasting methods in use and their results for the current year are reviewed by the meeting. These include statistical summary from the basic level to central level, sampling survey (including cutting-plot survey), remote sensing, agro-meteorological model, pure statistical model, and econometric model.

In addition, MOA organizes consultations with experts from agro-information units at provincial levels in major crop planting regions for a critical review of the provisional crop production forecasts.

Flowchart of crop forecasting process



3.2 CROP FORECASTING IN INDIA

1. Crop Statistics

Most States of India, accounting for over 95 percent of the cropped area, collect statistics on land utilization and crop area as part of updating of land records. This is done regularly by complete field enumeration by the primary village revenue agency. The area statistics collected at village level are added up and submitted to the next administrative level and so on. In the non-land record States crop statistics are collected through sample surveys or subjectively reported.

Crop yield statistics are collected in a majority of States on the basis of crop-cutting surveys on randomly selected plots, usually 5m x 5m. in size. The sampling design is stratified multi-stage

random sampling. The method is objective and has been practiced for a long time. Not less than 500,000 plots are selected for crop cutting every year, enabling the collection of yield data for 51 food and 15 non-food crops. In the remaining States, yield estimates are based on the traditional method of subjective reporting by the Agricultural Extension staff and other concerned persons.

2. Crop Forecasting System

There are long delays before crop area and yield estimates become available, following the methods described before. Therefore, the required advance crop estimates or forecasts are mostly obtained from other sources, such as reports on crop and weather conditions, the likely area of crop cultivation, take-off of crop inputs like seed of high yielding varieties and fertilizer and agricultural credit.

Among the various approaches tried with varying degrees of success are the biometric, agro-meteorological and econometric models and remotely sensed satellite data.

(3. Livestock Statistics System : deleted)

3. Organizational set-up

The institution responsible for co-ordinating activities relating to crop statistics, including crop forecasts, is the Directorate of Economics and Statistics (DES) of the Ministry of Agriculture. The responsibility for collecting and analyzing basic data for all crop statistics rests with the various states. The State Departments of Agriculture (DOA), the Market Intelligence Units (MIUs) of the DES, the Department of Space (DOS), the India Meteorological Department (IMD), Indian Agricultural Statistics Research Institute (IASRI) and many other institutions are involved in crop estimation and forecasting.

3.3 CROP FORECASTING IN THE CILLS[2] COUNTRIES

1. Introduction

The countries participating in CILSS include Burkina Faso, Cape Verde, Gambia, Guinea Bissau, Mali, Mauritania, Niger, Senegal and Chad.

Within CILSS the "Diagnostic Permanent" System (DIAPER) was developed, of which crop forecasting is one of the essential elements. The regional co-ordination has ensured that in each of the member countries a similar design has been used for cereal production forecasting surveys.

Furthermore a Market Information System has been set up and has proved itself very useful for an appreciation of the food situation.

2. Crop forecasting

Crop forecasting is one of the three components of the agricultural survey:

- Cereals yield forecast
- Agricultural production
- On-farm cereal stocks

The agricultural survey is regularly carried out in all member countries of CILLS, with a similar methodology:

- Sample survey of selected agricultural households
- Data collection of crop area
- Yield estimate by random crop cutting
- Production estimate on the basis of crop area and yield

[2] CILSS : Comité Inter-Etats de Lutte Contre la Sécheresse au Sahel.

Nevertheless there is some variation in methods employed:

- Crop area: either objectively measured or taken from farmers declaration
- Crop yield: estimated on the basis of plant density and ear size counts or taken from farmers declaration or based on eye estimates of the crop conditions.

For the purpose of the objective yield forecast the method generally applied is to place at randomly selected locations a square of 3 by 3 or 5 by 5 meters, similarly to the method used for crop cutting. Potential crop yield is obtained by multiplying the counted number of ears by the average weight of an ear, as established during the previous year.[3]

Although the random sample survey is in principle the main tool for crop forecasting, in reality the usual other assessment methods are also applied, including subjective crop reporting, agro-meteorological crop monitoring, satellite imagery and information on crop inputs, pests and diseases.

3. Crop Assessment Missions

A regular feature is the joint CILSS/FAO crop assessment mission, which serves to validate the provisional crop forecasts produced by member countries. Such missions normally take place during the last 3 weeks of October. All available information is used and checked, including the results of the sample surveys and the methods described in the previous paragraph. Much direct crop observation and interview of farmers and other knowledgeable persons is done during extensive field travel. An additional element for consideration is the price development of cereals and livestock, as provided by the Market Information System.

3.4 CROP FORECASTING IN ZIMBABWE

In Zimbabwe two crop forecasts are made during the main cropping season from Dec to June. Official crop forecasts are made for 10 crops, of which five food crops: maize, sorghum, finger millet, bulrush millet and groundnuts. Crop forecasts for other food crops, such as wheat and beans, are available in the relevant organisations. Preliminary forecasts are issued in March or April and the final forecasts are issued in May.

The organisations involved in this exercise are the Central Statistical Office (CSO), National Early Warning Unit for Food Security (NEWU) within the Agricultural Technical and Extension Services (AGRITEX), Farmer Organisations and Seed Companies. These organizations have been brought together in a National Crop Forecasting Committee. The Central Statistical Office publishes the official figures, which have been agreed upon by the Committee.

CSO carries out surveys in the large-scale Commercial Sector (by posted questionnaires) and also in the Communal Sector whilst NEWU produces crop-forecast figures for the small-scale Commercial and the Communal sector. The department of AGRITEX conducts data collection for NEWU. Visual assessments are done in the two sectors but a sample survey is also conducted in the communal sector. Agro-meteorological crop monitoring, using the FAO Water Balance method is also applied.

Farmer organisations produce figures for their members, and seed companies provide the overview of seed sales. During a committee meeting, all the organisations present their figures for each crop and the figures are discussed until one national figure is produced. A report covering all methodologies used by the organisations involved was produced by CSO in 1998.

[3] The assumption that the average grain weight per ear is the same as the previous year misses out on the impact of the specific growing conditions of the current year, for example drought; it is necessary to collect additional data such as length or size of the ears.

Users of the information are policy and decision-makers in Government ministries and departments, Non-Governmental Organisations and the private sector. The information is disseminated to the users by post from CSO and by request to other organisations involved in forecasting. NEWU uses the information in food security assessments, which are disseminated in monthly food security bulletins, and other reports.

3.5 CROP FORECASTING IN USA[4]

Introduction
Each month, the US Department of Agriculture publishes statistics and related information about crop production in the United States. Several USDA Agencies are responsible for preparing these statistics. The National Agricultural Statistics Service prepares the domestic crop forecasts. The Agencies involved have a solid record of objectivity and ability to meet established report dates. The security of the data before release is fiercely defended to ensure there is no premature disclosure of any of the information. USDA is also involved in monitoring crop production of major crops world-wide. Supply and demand estimates for major crops are prepared by the World Agricultural Outlook Board.

Domestic forecasts for each crop season begin with a winter wheat and rye seeding report in early January followed by a March report that gives a first look at what farmers intend to plant. This is followed in late June by a report of the acreage actually planted. Monthly yield and production forecasts begin in May for winter wheat, in July for spring wheat and other small grains, and in August for other spring-planted crops, concluding with estimates of actual production at the end of the harvesting season. NASS also conducts quarterly surveys of grain and soybeans stored on and off farms.

Crop production forecasts have two components: acres to be harvested and expected yield per acre. For example, preliminary corn and soybean acreage estimates are made using data obtained from a survey of farmers conducted during the first 2 weeks in June. Expected corn and soybean yields are obtained monthly, August through November, from two different types of yield surveys. Crop production forecasts are based on conditions as of the survey reference date and projected assuming normal conditions for the remainder of the season.

Estimate of crop area
The largest single survey NASS conducts each year is the June Agricultural Survey. During the first 2 weeks in June, about 2,400 interviewers contact over 125,000 farmers, either by telephone or in person, to obtain information on crop acreage, grain stocks, and livestock inventories. These producers are asked to report the acreage, by crop, that has either been planted or that they intend to plant, and the acreage they expect to harvest as grain. Data from this survey are used to estimate total acres planted to corn, soybeans, and other crops regardless of the intended uses. Preliminary projections of acres to be harvested for grain or soybeans, including seed, are also made using these data. This survey also provides estimates of quantities of grain stored on farms and livestock inventories.

The sample design for this survey utilizes two different sampling frames. The area frame, which is essentially the entire land mass of the United States, ensures complete coverage of the US farm population. The list frame, a list of known farmers and ranchers, does not provide complete coverage of all farms, but allows the use of more efficient data collection methods.

Sampling from the area frame is a multi-step process. First, all land in each State is classified into land use categories by intensity of cultivation using a variety of map products, satellite imagery, and computer software packages. These land use classifications range from intensively cultivated areas to

[4] based on USDA Misc. Publication no. 1554 (Vogel and Bange)

marginally cultivated grazing areas to urban areas. The land in each use category is then divided into segments ranging from about 1 square mile in cultivated areas to 0.1 square mile in urban areas. This allows intensively cultivated land segments to be selected with a greater frequency than those in less intensively cultivated areas. Segments representing cultivated areas are selected at a rate of about 1 out of 125. Sample segments in land use classifications with decreasing amounts of cultivated land are selected at rates ranging from 1 out of 250 to 1 out of 500.

About 10,000 area segments are selected nation-wide for the survey conducted each June. Using maps and aerial photos showing the exact location and boundaries of each sample segment, interviewers locate and interview every operator with land inside the segment boundaries to identify crops planted in each field, and to obtain livestock inventory information, and quantities of grain in storage. A similar survey is conducted in early December which provides a measure of winter wheat acres planted.

Before sampling from the list, each farm is classified by various characteristics such as number of acres by crop. Large farms are sampled at high rates. For example, Illinois farms on the list with over 5,500 acres of cropland, or grain storage capacity exceeding 500,000 bushels, are selected all, as are Iowa farms with over 5,000 acres of cropland. Smaller farms are selected at rates of 1 out of 25 to 50.

About 75,000 farms across the United States are selected from the list to be surveyed during the same time period in June. Farmers on the list sample are asked to provide total acres planted for each crop on all the land they operate, and quantities of grain stored on their operation. Most of the data from this sample are collected by telephone interviewers.

Data from the area and list samples are combined using multiple-frame statistical methodology developed jointly by NASS and Iowa State University, which ensures that all land areas in the United States can be accounted for once and only once. The June Agricultural Survey is sub-sampled for surveys in July, September, December, and March for the basic livestock inventory, crop production and quarterly stocks estimates.

Generally, estimates of planted acres from the June Agricultural Survey are not changed during the crop season, unless the planting season has started exceptionally late. When this happens, adjustments to planted acres estimates are made at the time of the first yield forecast in August.

Yield forecasts

A sub-sample of farmers who respond to the list portion of the June Agricultural Survey is selected to provide monthly crop yield projections. This provides a way to screen farmers so that only those currently growing the commodities of interest are contacted during the monthly surveys. This sub-sample may be supplemented with other known growers randomly selected from the list frame when monthly district level production forecasts are required for some States.

The sample farmers are asked what they expect their crops to yield before harvest, and actual yields obtained at harvest. All yield data for an individual report are weighted by the farm's harvested crop area.

Objective Yield Surveys are conducted monthly in States that contribute most heavily to total US production of corn, soybeans, cotton, and wheat. Crop yield is estimated on the basis of counts, measurements and weights obtained from small plots in a random sample of fields. The variables recorded for each crop are:

- Maize: number, size and weight of ears
- Soybean: number and weight of pods
- Cotton: number and weight of bolls
- Wheat: number and weight of ears

Sample corn, soybean, cotton, and spring wheat fields are selected from those identified in the area-frame sample portion of the June Agricultural Survey. Winter wheat sample fields are selected from the fall area-frame survey. Observations within each selected field are made in two randomly located plots. Plots include two or three adjacent rows of predetermined length.

Harvested yield can be defined as biological or gross yield minus harvest loss. Counts, measurements and other observations from each sample plot are input to statistical models based on historical data to predict final number of fruit and final weight per fruit. A forecast of gross yield is calculated by multiplying these two components together and dividing by land area.

Plant characteristics used as prediction variables change as the crop maturity progresses. At an early stage, plant counts may be the only data available for forecasting the number of mature fruit. As the crop matures, actual fruit counts can be used, and weights and measurements of the immature fruit are used to predict final weight per fruit.

The same plots are revisited each month until the crop is mature. At that time, the plots are harvested and final counts and weights are obtained. After the entire field has been harvested, the sample field is revisited and two more plots are laid out. The grain left on the ground in these plots is picked up and weighed to provide a measure of harvest loss.

When harvest is complete, the farmers who operate the sample fields are re-contacted to obtain final harvested acres and yield for the sample field.

USDA also has the resources to carry out weather analysis and interpretation of satellite imagery for its monitoring of crop production world-wide. Apparently this approach is not followed for domestic crop production, as forecasts and estimates rely completely on the various surveys described before.