

The Integrated Survey Framework in the Redesign of Sample Surveys in China Agricultural and Rural Statistics

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Abstract

In China, the National Bureau of Statistics (NBS) is responsible for both of agricultural production statistics and rural socio-economic statistics which are mainly conducted by sample surveys through out the whole country. The ongoing sample surveys are targeting for estimation of provincial population which includes: rural household surveys and poverty monitoring surveys, crop acreage and yield surveys, livestock surveys, agricultural producer price surveys, intermediate consumption surveys for agricultural products. Every five years, the NBS will implement a complete sample rotation to draw new samples to replace the old samples.

Taking advantage of a complete sample rotation in the year 2010, the Department of Rural Surveys under NBS is aiming at implementation the “Global Strategy to Improve Agricultural and Rural Statistics” in the Chinese context. The NBS is emphasizing two aspects of survey methodology improvement which are conceptual (indicator) framework and integrated survey framework. On one hand, we are trying to adjust the contents of ongoing surveys in line with the recommended core indicators of the global strategy to improve the current questionnaires. On the other hand, we are trying to construct a master sample frame to redesign the ongoing sample surveys such as crop surveys and rural household surveys in an integrated approach.

1. A retrospect of China’s agricultural and rural statistics

1.1 Since the founding of the People’s Republic of China till now, the National Bureau of Statistics (NBS) of China adopts a parallel way to collect information on agricultural and rural statistics which are complete statistical reporting and sample surveys. On one hand, the complete statistical reporting is used to collect information

on agricultural production, added value of agricultural products and agricultural conditions for farming. On the other hand, since 1954 the NBS started to conduct rural household surveys, a unified sample scheme for provinces was implemented through out the entire country considering China with the vast land and large population. Since 1963, the NBS launched the crop yield survey by cutting several major crops for yield estimation. During China's Cultural Revolution, the above two kinds of sample surveys are ceased until early 1980's.

1.2 Until the year 1984, the NBS decided to set up a specialized survey team which is called the Rural Survey Organization to conduct agricultural and rural statistics by utilizing sampling technique. Since then the official statistical figures for crop outputs and farmer's per capita income at province level are estimated by sample surveys. At the first stage of sample design, 857 counties throughout China are selected as the primary sampling units (PSUs), which is account for more than one third of the total counties of the entire country. Accordingly the survey teams at those counties were set up to conduct sample surveys on rural household income and expenditure, crop yield, rural socio-economic situation, aiming to provide more timely and accurate information on agricultural and rural statistics.

Since the establishment of the survey team at the county level in 1984, the NBS conducts sample rotation by completely rotating out the old samples and reselecting new samples every five years. In 1990 and 1995, the NBS had conducted sample rotation under the level of existing sample counties. At that time the survey was limited for rural household surveys, crop yield surveys and rural socio-economic surveys. The sample scheme was basically a multi-stage sampling with villages as the secondary sampling units (SSUs) and households or tracts as the final sampling units (FSUs) for the field data collection.

1.3 The first agricultural census '1996 of China was successfully conducted in the year 1997. Based on the results of agricultural census, an improvement of sample design for ongoing surveys was completed in order to meet the increasing user needs for agricultural and rural statistics. In China, every five years a complete sample rotation is implemented by selecting new samples to replace the old ones. In 2000 sample rotation, more subject matters of surveys were introduced to ongoing surveys, which meant the survey scopes were extended from rural household surveys, crop yield surveys, rural socio-economic surveys to major crops acreage, livestock inventory, farmer's fixed assets, agricultural producer prices as well as agricultural intermediate consumption. In order to optimize the multi-purpose of the surveys, with the assistance of the National Agricultural Statistics Service (NASS) of the Department of Agriculture of United States, a new sample design which is called the multivariate probability proportional to size (MPPS) sampling was introduced to select samples. Meanwhile the conceptual framework for an integrated surveys are established since that time. In 2005, another round of sample rotation was carried out which basically adopted the methodology used in 2000 with minor revising.

1.4 In 2010, the NBS is now undertaking a nationwide sample rotation for agricultural and rural surveys. Taking advantage of the results of second agricultural census, a set of new samples for ongoing surveys are selected to replace the old ones to overcome the sample attrition as well as the negative impact on sample representativeness. In addition, the conception of an integrated survey framework is adopted to improve the survey design in order to meet the multiple user needs and expanded subject matters, which is actually China's implementation plan to the "Global strategy to improve agricultural and rural statistics" .

1.5 In China, the Ministry of Agriculture (MOA) as a major line ministry is responsible for the policy making of agriculture and rural economic development strategy. In order to supervise the result of relevant policy implementation, MOA also undertakes a number of agricultural and rural statistics around its business functions, which is a complementary to China's overall agricultural and rural statistical system. MOA mostly adopts the complete statistical reporting and intended key-point surveys, while the NBS mostly adopts sample surveys for agricultural and rural statistics. The official statistics for grain production and farmer's disposable income are released by the NBS. The statistics of marine and freshwater fisheries, agricultural product costs and agricultural consumer prices are major statistical outputs from MOA.

2. The challenges encountered and the opportunities

2.1 The challenges encountered

In the Chinese context, with the rapid economic and social development, the agricultural and rural statistics are encountering new challenges from the emerging needs of government and public users.

Firstly, the agricultural and rural statistics mainly depend on sample surveys, complemented with the remaining complete statistical reporting from administrative sources in parallel. At national level, a strategy to improve the methodology of agricultural and rural statistics has been set up, which is to improve and strengthen the sampling method to collect agricultural and rural statistics by taking advantage of the list frame provided by agricultural census. In the near future, the remaining complete statistical reporting would be gradually replaced by the means of sample surveys. The current sample survey schemes have been expanded to include surveys on livestock inventory, migrate labors, agricultural producer prices, agricultural intermediate consumption and so on. In addition, some ad hoc surveys on contemporary agriculture, rural welfare society, sustainable agriculture are conducted from time to time. In comparison with the survey's conceptual framework of Global Strategy, which composes the economic, social and environmental dimensions, the contents of the agricultural and rural surveys in NBS do not cover too much on fishery, aquaculture, forestry, land and water use, agricultural production inputs etc. A wider scope of sub-sectors of agriculture and rural development should be monitored by sample surveys.

Secondly, the current statistical indicators for agriculture and rural development need to be examined and refined. At present, the existing indicators appears in both

complete statistical reporting and sample surveys, some of them may overlap in the two means of data collection. In addition, some indicators in the surveys for agriculture and rural development is out-of-date and redundant. With the sample surveys to be extended to replace the remaining complete statistical reporting, an upgrading indicator system for agriculture and rural development in China is undertaking to establish and some new indicators such as agricultural production inputs, changes in land cover and use is added in.

Thirdly, in the Chinese context the government at various administrative management levels is responsible for economic development management in its own jurisdiction; therefore the statistical information is needed by different levels of government. At present, the sample surveys for agricultural and rural statistics are designed for provincial estimation as a target population, while the summary results could not break down to accurately estimate lower level areas such as prefecture and county. Taking consideration of the governmental needs at various levels as well as the public demands, an integrated surveys are priority solutions to meet statistical needs for different users. To this end, we propose a hierarchical approach of sample design under the Chinese circumstance, which is to provide a standardized sampling scheme for provincial population at national level and allow the provincial statistical staff to expand sample size and add some commodities of interest to meet the statistical needs at both prefecture and county levels.

Fourthly, the internal drive for methodological improvement to agricultural and rural statistics. For a long time, China is a society with the dualistic structure of rural and urban division; hence the household surveys implemented by the NBS are divided into urban survey and rural survey separately. It results in the income concepts and sampling method adopted by urban household survey and rural household survey are not fully comparable. Another survey scheme need to be improved is crop acreage survey, of which sample design is based on the list frame due to the lack of availability of area frame.

2.2 The opportunities

In recent years, the NBS has laid emphasis on the statistical methodology improvement and statistical capacity building, one of the major areas is the methodology reform and innovative activities on agricultural and rural statistics.

First, the management level of NBS always lay emphasis on the statistical data quality, in 2010 the top management of NBS proposed an initiative on “three improvements” which means to improve the statistical capacity, survey data quality and official statistical accountability. The NBS is now working on its own “National Strategy for the Development of Statistics (NSDS)” for the period of twelfth national plan during the year from 2011 to 2015. The strategy for the development of agricultural statistics has definitely been integrated into the NSDS. In the Chinese version of NSDS, the “Global strategy to improve agricultural and rural statistics” endorsed by the UNSC in February 2010 has become a very useful instrument for NBS to steer the methodology improvement.

Second, the second agricultural census’2006 of China completed successfully at

the year 2007 could contribute a good list frame to improve sample design for ongoing surveys. A master sample frame has been developed by using the results from the agricultural census. In this year's sample rotation, the sample enumeration area (village) is selected based on this master sample frame, and then an area frame is constructed by field investigation within the selected sample enumeration area (village).

Third, the current ongoing sample rotation in 2010 provides a great opportunity to redesign our current sample surveys in order to make improvement. Throughout the redesign, the "Global strategy to improve agricultural and rural statistics" is used as a valuable reference to select core statistical indicators, and is also applied as the principle to implement an integrated surveys across the nation.

Fourth, several pilot surveys aiming to improve the current agricultural and rural statistics are being conducted. There are three influential pilot projects which are going to extend to nationwide later on. One is the integrated urban and rural household survey, the second one is the crop acreage surveys based on area frame, the third one is the crop acreage measurement by remote sensing.

2.3 Innovative activities

First, integrated urban and rural household surveys. Since the second half of year 2007, under the international technical assistance from the Statistics Canada, a pilot on integrated household survey has been completed in four selected counties from Beijing, Zhejiang, Henan and Sichuan respectively. The pilot adopted the unified urban and rural classification, survey indicators, sampling method and data processing throughout both the urban and rural areas. The one year duration survey has tested the sample design, questionnaire design and the survey approach. Based on this pilot survey, an integrated urban and rural household survey scheme will be proposed and implemented in near future.

Second, crop acreage pilot survey based on area frame. Since the second half of 2009, the NBS has been conducted a pilot survey on crop acreage based on the area frame in six counties from Liaoning, Jilin, Anhui, Jiangsu, Henan and Xinjiang respectively. In China the second land use census has just been completed by the Ministry of Land and Resources(MLR) of China. The satellite image of remote sensing for those pilot areas has been shared with the NBS for the purpose of pilot survey on crop acreage. In those 6 counties, an area frame has been constructed after the images to be processed, so that strata, PSU and segments are delineated for sampling purpose.

Third, crop acreage measurement by remote sensing. Under the funding support of the Ministry of Science and Technology of China, from 2006 the NBS jointly work with relevant research institute to launch a project of remote sensing application on crop acreage measurement as well as yield monitoring. Pilots have been conducted in Jilin, Jiangsu, Henan, Hubei to estimate the major crop acreage by using full coverage image of remote sensing. In general, the acreage measurement for several major crops is based on multi-dimensional satellite images, plus some selected segments for ground truth observation. By the end of this year, a preliminary summary of remote

sensing application on crop acreage will be completed. This would be a guide for extending the remote sensing application to more provinces in China.

3. Integrated agricultural and rural surveys

3.1 Integrated agricultural and rural surveys

For the time being, the integrated agricultural and rural surveys conducted by NBS refer to the annual surveys in crop acreage and yield, livestock inventory, rural household income and expenditure, agricultural producer prices and agricultural intermediate consumption. As we have mentioned previously, the remaining complete statistical reporting in agricultural and rural statistics is now used to a limited extent, so the sampling approach is mainly adopted for integrated surveys. In addition, the integrated surveys should also consider multiple user needs in the context of Chinese situations. The sample design for provincial estimation should allow additional samples to be integrated in order to produce the estimates for prefecture or county levels. In the near future, the integrated agricultural and rural surveys will include not only more survey subject matters such as acreage and yield for small crops, quantity of fishery captures and aquaculture production etc., but also additional data sources such as remotely sensed data and administrative data as a whole.

3.2 The features of 2010 agricultural and rural sample rotation in China

The 2010 agricultural and rural sample rotation is regarded as a platform to improve sample design and reselect samples for agricultural and rural surveys in China. The 2010 sample rotation has three significant features. First, the list frame which is developed by using the results of the second agricultural census is used as a master frame for sample selection. For the time being, the area frame under the level of sample enumeration areas (villages) is constructed as a complement to the list frame. Second, the sampling scheme for ongoing agricultural and rural surveys has been improved by taking advantage of a combination of list frame and area frame. Third, the scope of sample rotation includes most of current sample surveys related to agricultural and rural statistics organized by the NBS, including rural household survey, crop surveys, migrant labors monitoring survey, agricultural producer prices and agricultural intermediate consumption survey and so on. The only exception is the livestock inventory survey of which the samples are selected two years ago and remain to be used.

3.3 Constructing sample frame

The second agricultural census outputs detailed information on rural permanent residents, rural labor resources, rural infrastructures, farm production conditions, crops acreage and agricultural productions etc. at enumeration area and administrative village levels, which summarized through the census enumeration of individual household and non-household agricultural holdings. For the purpose of this year's sample rotation in China, list frame both on enumeration area and household levels are generated. Taking consideration of time lag of the reference date of the agricultural census in 2006, those enumeration areas within the villages which occurs

collapse and merger is updated for some key indicators such as the number of permanent residents, the arable land area etc. by an on site check.

For the time being, China still face some constraints to construct the area frame for agricultural and rural surveys for the whole country. The acquisition of satellite image used for constructing the area frame is one of obstacles. After completion of the satellite image processing for the second land use census organized by the Ministry of Land and Resources (MLR), the results would be shared with the NBS and then could be applied to develop an area frame.

In 2010 sample rotation for agricultural and rural surveys, a list frame is developed from the results of second agricultural census' 2006. We select enumeration areas as PSUs in first stage sampling. Before we select sample household or sample segment, local staff manually fabricate an area frame in those PSUs by an on-site investigation. More specifically, a sketch map of dwellings or land segments is drawn as a frame to select households or segments within the sample enumeration area (village).

3.4 Sampling schemes for ongoing surveys in 2010 sample rotation

3.4.1 Rural household survey

The rural household survey is moving towards to integrating the rural household survey and urban household survey into a unified household survey. The redesigned rural household survey adopts the new classification of urban and rural divisions and accordingly adjusts the survey coverage of the rural household survey. In addition, the income concept and survey indicators for rural household survey are harmonious with the urban household survey.

Under the existing sample counties, a two stage sampling method is adopted to select sample enumeration areas and households. The probability proportional to the total permanent residents (PPS) is used to select sample enumeration areas. Within the sample enumeration areas, a systematic sampling method is used to select household with equal probability. The survey scope includes income, expenditure, agricultural operation costs, housing, labor force etc. at household level. Diary keeping is adopted to collect information on expenditures at household level.

3.4.2 Crop surveys

Under the existing sample counties, a probability proportional to operational arable lands (PPS) is adopted to selected sample enumeration areas using the same master frame developed from the results of agricultural census. Within sample enumeration areas, an area frame composed of land segments with almost the same amount of acre (or mu) is constructed for sampling purpose. Generally speaking, around five sample segments are selected from each sample enumeration area for major crop acreage surveys, including for rice, wheat, corn and cotton. For the purpose of crop yield estimate, a sub-sample of those sample segments is selected to do the crop-cutting on site.

3.4.3 Surveys on Agricultural producer prices and agricultural intermediate consumption

For the purpose of compiling agricultural producer prices as well as estimating

the intermediate consumption for the agricultural production, sample farmers and sample non-household agricultural holdings are selected in those sample counties which are the same counties as rural household surveys and crop surveys. It is more likely to select relatively larger farmers or non-household agricultural holdings in terms of its agricultural outputs. The survey scope includes more than 40 categories of farm products in crop, forestry, livestock and fisheries sectors.

4. Further improvements in the near future

4.1 Speeding up the integrated urban and rural surveys

The top management of NBS has decided to speed up the integrated urban and rural surveys as a strategy to strengthen the statistical capacity building. From now on till 2013, the current two parallel implemented household surveys both in urban and rural areas are going to be gradually unified as one survey. From year 2013, the integrated urban and rural survey will be implemented in a unified questionnaire and sample scheme no matter where in urban or rural areas.

4.2 Extending the crop acreage surveys based on area frame

The present sampling scheme of crop surveys in 2010 sample rotation is suitable to the transitional period of changing the sample design of crop surveys from list frame based to area frame based. The NBS still need some time to develop an area frame for entire country since the results of Second Land Use Census provided by the Ministry of Land and Resources (MLR) is not available right now. This year the NBS is conducting an extended pilot surveys of crop acreage in Jiangsu and Henan province based on the area frame, since the previous pilot there have achieved preliminary results. In the next 2-3 years, the NBS is going to extend the crop surveys based on area frame to the major growing areas of crops in China. In summary, through the improving of the sampling scheme, the quality and accuracy of the estimates of crop surveys should be definitely improved.

4.3 Improving the management mechanism of sample surveys for agricultural and rural statistics

At present, the NBS has a subordinate survey office at each province of China; each provincial survey office is responsible for the agricultural and rural surveys which are conducted at sample counties. There are altogether approximately 850 nationwide sample counties which were selected in 1984. Since then the approximately 850 sample counties have been fixed as a first stage samples because the survey team has already set up there. With the expanding of survey scope, the constraints of fixed sample counties have showed negative impact on sample representativeness and therefore it is necessary to make sample counties more flexible. In addition, the NBS will start to launch a yearly sample rotation with a proportional samples to be rotated in and out.

4.4 Strengthening the statistical capacity building

The NBS has initiated a campaign of three improvements which is to improve

the statistical capacity, survey data quality and official statistical accountability. The top management of NBS is targeting to strengthen the statistical methodology and capacity building. The Department of Rural Surveys under the NBS has also taken measures to strengthen the statistical data quality, and has made a guide on total quality control on the major indicators of agricultural and rural surveys. This guide of “total quality control” keeps track of the quality of the critical points such as field operation, data processing and estimation in the whole procedure of survey results to be produced. We believe that a more accurate, relevant and timely information on agricultural and rural statistics will be achieved through these efforts.

In conclusion, the NBS is now practically improving the methodology of its agricultural and rural surveys by taking advantage of implementation of the “Global Strategy to Improve Agricultural and Rural Statistics” in Chinese context.