

Agriculture and its Integration with National Accounts Statistics:

The Indian Case¹

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Abstract

This paper examines the selected domains of database on agriculture in India and its use in the national accounts statistics. Though at the national level the share of agriculture in total value added has declined considerably to less than a quarter, there are several states, which are agriculture-dependent. Besides, even at the national level agriculture provides sources of livelihood to more than half of the total work force. Hence, the reliability of agricultural statistics and their integration to national accounts are of great significance from the productivity point of view as well. The paper examine in detail the methods and sources used to collect statistics on acreage and yield of agricultural crops and also their limitations. The paper next discusses evolution of the national accounts statistics in India and treatment of the agriculture sector therein. We also describe the methodology used to estimate contribution of the agriculture sector in present system of the national accounts. The paper concludes with a section that highlights some of the problems related to the treatment of the agriculture sector in the national accounts in its present form. In suggesting that the services sector value added has expanded much faster than that in the agriculture sector, many issues such as, how well the agriculture sector data compare and can be integrated with the value added originating from the industrial sector or the services sector, need to be tackled very carefully.

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This paper discusses selected domains of agricultural statistics in India and its use in valuation of economic activities in the country. A critical assessment of the entire National Accounts Statistics (NAS) is quite an ambitious task and in this paper we only try to touch the tip of the iceberg by focusing on the agriculture sector.² In 2007-08, Agriculture and Allied Sectors accounted for 16.4 per cent of the country's gross domestic product (GDP) with agriculture alone contributing about 14 per cent of the GDP (Govt. of India 2010, p. 179).³ The share of agriculture in GDP has declined considerably over the years though in terms of work force composition agriculture still continues to provide livelihood to more than half. The services sector value added has been expanding in the Indian context much rapidly than the commodity producing sector. The role of agriculture in boosting the overall growth is, therefore, diminishing over the years and also the sluggish labour productivity growth in agriculture has been quite alarming. In the backdrop of these broad patterns of change we take a critical look at the methodology used for collection of data in the agriculture sector and, more importantly, the quality of the available data.

Major domains of agricultural statistics include statistics related to production, land use, prices, fertilizers, employment, credit and trade of agriculture produces. We focus on the first two categories only, viz., production and land use, because these form the backbone of the database required for estimation of the national income. In this study, production domain covers statistics related to area and yield of the crops, and production from various crops, livestock and fisheries. Under the land use, our primary concern is the statistics on gross and

² Similarly, it is very difficult to take stock of entire statistics covered under the title 'agricultural statistics' and we focus on its selected domains, as discussed in the subsequent paragraph.

³ A note on terminology being followed: the National Account Statistics (NAS) of India reserve the term 'Agriculture and Allied Activities' to include agriculture proper, livestock (and animal husbandry) and operation of irrigation systems; forestry and logging, and fisheries are not a part of it whereas the Economic Survey uses the term 'Agriculture and Allied Sectors' to include all the above activities. Since this study is more concerned with NAS; the term 'Agriculture and Allied Activities' excludes forestry and logging, and fishing. However, the word agriculture/ agriculture sector includes the livestock and the irrigation systems.

net cropped areas and area irrigated. Gauging the actual situation regarding the two is also important since these estimates are widely used in forecasting the agriculture output thereby assisting the food policy. The supply side shocks notwithstanding, recent food spikes in food prices are a gentle reminder of the crisis that can be unfurled in future if food is not managed properly. For each category, we discuss the data sources, their scope and limitations of information collected.

The paper is organized in three sections: the first section critically analyzes the database on the major domains discussed above. The second section traces various stages in the evolution of present form of NAS in India and also how the agriculture sector is integrated into the NAS. The third section reviews some issues on incorporation of the agriculture sector in the NAS.

I. Agricultural Statistics in India: Major Domains

We discuss the statistics on land use, production in agriculture, their limitations and the sources of data. Unlike the cases for the population census and industrial statistics, no specific legal provisions or act exists in the country for canvassing and compilation of information on crop production and land use periodically.

I.1 Statistics on land use and production

Estimates on production are derived from the estimates on area and the yield. We first dwell upon the methodology that is being followed to estimate land use and crop area and then we turn to yield. For the purpose of collecting statistics on estimation of acreage for various crops and land utilization, the country based on the manner in which land records were collected for managing the land revenue system during the Colonial India has been divided into two broad categories of states/UTs. In the first category are the so called ‘temporarily settled’ (TS) states/UTs, where land revenue was fixed for definite period and was revised at the end of the period. In such states a village revenue agency maintains the land records – usually a reporter known as *Patwari*, *Lekhpal*, *Karnam* etc., in different states who are apparently well aware of agricultural and economic conditions, visits the villages under his jurisdiction and enumerates the pattern of land use and acreage of different crops. In the second category are the

states/UTs known as ‘permanently settled’ (PS) where the tax rate was fixed in perpetuity. In such states, officers at police *thanas/ chowkidars* manage the land records. Not these personnel only are untrained for this purpose; they are often in charge of 100-150 villages, which make their task even more difficult. These village totals are consolidated to obtain the figures for successive hierarchy of administrative units like *tehsil*, district and state.

At the time of independence, land use statistics were available under five categories: (i) forests, (ii) area not available for cultivation, (iii) other uncultivated land excluding current fallows, (iv) fallow lands, and (v) net area sown. Since 1950-51, following the recommendation of a Technical Committee of 1949, a more detailed nine-fold classification was adopted based on the above five categories: (a) forests: (i) forests, (b) area not available for cultivation: (ii) area under non-agricultural uses, (iii) barren and uncultivable land, (c) other uncultivated land excluding current fallows: (iv) permanent pastures and other grazing lands, (v) miscellaneous tree crops and groves not included in the net sown area, (vi) cultivable waste, (d) fallow lands: (vii) fallow lands other than current fallows, (viii) current fallows, (e) net area sown: (ix) net area sown. Now, a twenty two-fold classification is being proposed.⁴ The total geographical area of the country is 329 million hectares, of which 305 million hectares is the ‘reporting area’ for land use statistics in 2001-02 (Govt of India 2009).⁵ Of the remaining 23 million hectares, about 18 million hectare is located in Jammu and Kashmir and other in hill-tracts of the north-eastern India. Of the reporting area, forests account for 23 per cent, uncultivable and fellow lands (categories (b) and (c) above) for 34 per cent and the remaining (about 46 per cent) is net area sown.

For estimation of acreage, the states/UTs are divided into three categories.⁶ In addition to the TS and PS states, which account for 86 and nine percent of the total reporting area, there exists a third category of states which have neither a cadastral map nor village officials to conduct surveys. They mostly comprise hilly and forest areas. Area statistics, reported in

⁴ The revisions in classification schemes, although helpful in organizing the database better and in canvassing more information, may introduce inter-temporal incomparability in the data due to definitional problems (see Bansil 2002 for some examples on this).

⁵ Reported area is the area for which data is available and may or may not match the geographical area.

⁶ See Bansil 2002 and Ghosh et al. 2008 for further detail.

these states are based on personal knowledge of revenue officials as well as on past knowledge and experience.

Estimates for yield are based on the crop cutting experiments (CCEs) initiated under the General Crop Estimation Surveys. Prior to independence, the estimates of yield were based on 'standard yield' and 'crop conditioning factor' in an area. Presently, the same is estimated from crop cutting estimates which involve the following different steps: (i) random selection of a field, (ii) locating and marking an experimental plot within the fields, (iii) harvesting the crop within boundary of the plot, and (iv) adjustments for driage. Normally, the field staff carrying out such work is well trained.

1.2 Statistics on land use and production: limitations and efforts to overcome them

The statistics on acreage under different crops and the land use statistics are usually available with lag of two years due to delay involved in various stages of data collection: often the *patwaris* are overloaded with different duties. To reduce this time-lag and enhance the utility of the statistics for users, the Ministry of Agriculture, in late 1960s, launched a scheme named Timely Reporting System (TRS), whereby reliable and timely estimates of acreage in principal crops in each season would be made available within two months of sowing of the crops. *Patwaris* would collect information on a priority basis in randomly selected 20 per cent of the villages in selected states (at present 13 major states and two UTs).

In the PS states, where TRS is not possible due to absence of required institutional structure at the village level, as per the recommendations of a working group, 'Establishment of an Agency for Reporting of Agricultural Statistics' (EARAS) scheme was implemented since 1975-76. The scheme envisages establishing an agency to carry out complete enumeration in randomly selected 20 per cent of the villages to provide timely estimates of area and production under the principal crops.

To improve quality of statistics, Improvement of Crop Statistics (ICS) was initiated in 1975. The scheme is in operation in the 13 states where TRS is in operation and involves checks on area and yield based on independent information collected from about 10,000 villages and

31,000 experiments. The discrepancies between the two sources - the enumeration by the *patwaris* (for area estimates) and CCEs (for yield estimates), and the ICS - are then assessed. During 1994-95 to 1998-99, the ICS indicated 30-40 per cent error in area reporting by the *patwaris*, which has been attributed to three types of errors: (i) crops grown but remain unreported, (ii) crops not grown but reported, and (iii) incorrect reporting of area under the crops. Similar discrepancies were observed in yield estimates.

Despite the above schemes, there still remain problems with quality and scope of the data on land use, acreage and yield in India. Even the three schemes discussed above have not been able to achieve their desired objectives of providing timely and quality data. Many states were reported delaying submission of the area estimates within the period stipulated under TRS and EARAS (Bansil 2002, pp.141-44). Sometimes, the coverage of the data too is incomplete. Although ICS has pointed out deficiencies with the system of collecting crop statistics by the states, it has not been implemented properly due to such problems as non availability of equipments to conduct the CCEs.

The Indian Government, time to time, has constituted several expert groups to look into the statistical problems related to agriculture sector. The government agencies also organize periodic seminars on these issues – every year a ‘National Workshop on Improvement of Agricultural Statistics’ is being organized at the time of releasing the Forth Advance Estimates in June/July (discussed in one of the subsequent sections). One of the seminars which was held several years back in 1972 came out with the following recommendations:

- i. The land use data used to be collected through *patwari*. Though, it was collected on a complete enumeration basis its reliability was questioned as the individual was assigned several tasks at one point of time. Hence the seminar recommended that periodic sample surveys need to be conducted to check its validity.
- ii. The progress of the Timely Reporting Scheme (TRS) was slow. Hence the information on irrigated and unirrigated areas had to be collected fast.
- iii. Along with the prices of major crops the seminar recommended that the Ministry of Agriculture must collect data on major inputs like water, fertilizer, electricity and fuel.

- iv. In the case of those commodities which were subjected to price control published statistics reported only the controlled prices and not the open market prices. For the analysis of the trend, however, it was felt that the open market prices were of greater importance which could be collected by NGOs in case the government agencies had difficulty in reporting them.
- v. Input data were of poor quality. For example in the case of fertilizers there was a need to get reliable estimates of actual sales and stocks at the retail level and on allocation of fertilizers between crops.
- vi. Data on area coverage under irrigation, HYV seeds etc were based on certain norms which had to be made reliable through appropriate surveys.
- vii. The information on input-output was not adequate and there was a need for reliable data on cost of production.
- viii. The practice of using the land records to extract information on land holdings and land use pattern was erroneous and hence there was a need for better information on land holdings, incomes, savings etc. of the agrarian structure.
- ix. Different sample surveys covered different aspects of agriculture. Hence there was a need for maintaining coordination among them by creating an independent national organization for conducting agricultural surveys.

From the supply side the paper by Srinivasan and Vaidyanathan (1972) highlights a number of limitations relating to the land use data. The primary reporting agency in different states and in the treatment of particular items (e.g., area under mixed crops and source of irrigation) is a major problem. Some states did not even maintain up-to-date records. Whether the situation has improved over time is indeed an important question, if we wish to have a comparable dataset across states. The intensity and quality of water supply for example was not considered which could vary from region to region. Hence the estimate of irrigated area and the area sown more than once might have resulted in an overestimate of agricultural output in the National Accounts Statistics. In the present context how much of the decline in the share of agriculture in total GDP is therefore real and how much is due to an improvement in the data quality is a pertinent question.

Apart from the long time lag involved in collection, compilation and releasing the above statistics, which has been a longstanding problem and is inevitably a part of the every committee/ seminar that is organized on the agriculture statistics in India, there are other problems with the acreage, land use and yield estimates. There are large variations in the estimates of same statistic generated from the different sources and there is hardly a proper explanation for such discrepancies. This was major agenda for 'National Workshop on Improvement of Agricultural Statistics' of 2007 and the Workshop concluded that lack of proper coordination, validation and monitoring among the state agencies as responsible for this.

A Committee comprising eminent agriculture professionals was constituted by the Government of India in February 2009 under the chairmanship of Prof A Vaidyanathan with aims to review the current methodology used in TRS, EARAS, ICS and General Crop Estimation Surveys; suggest ways and means to ensure timely availability of reliable estimates; and to review the use of technology such as the remote sensing for acreage and yield estimation. The Committee would submit its report by December 2010.

I.3 Data sources

In general, the primary statistics on agriculture in India is collected by the states agencies known as State Agriculture Statistics Authorities (SASAs) which is then compiled by the Directorate of Economics and Statistics under the Department of Agriculture and Cooperation, Ministry of Agriculture (DESAg). The primary sources of information for DESAg are Land Use Statistics (LUS), Area and Outturn of Principal Crops and the Cost of Cultivation Studies (CCS). In fact, DESAg is single most important agency for data on agriculture and publishes 'Agriculture Statistics at a Glance' (ASG) containing both cross-sectional and time series information annually.

Since the final estimates of production from area and yield would be available only after some time lag, 'advance estimates' at four different points in a year are made available for 27 major crops to assist various policy related decisions⁷:

- First Advance Estimates: released for *kharif* crops during September every year and *kharif* crops are at advance stage of maturity.
- Second Advance Estimates: released in January when first assessment of *rabi* crops is made and the first advance estimates of *kharif* may get revised.
- Third Advance Estimates: in March/ April when earlier assessments of both *rabi* and *kharif* undergoes revision.
- Fourth Advance Estimates: in the month of June/ July every year, third advance estimates are revised and since most of the *rabi* crops are harvested, SASAs are in a position to supply both the *kharif* and *rabi* season estimates.

After the fourth advance estimate, the DESAg releases final estimates in December/ January of the following agricultural year. The final estimates for the previous year are also released along with these estimates. The estimates of value of output for the 45 principal crops are prepared using the production figures compiled by the DESAg and the prices relating to the peak marketing period prevailing in the primary market centres compiled by the state Directorates of Economics and Statistics (DES's). In the case of minor crops like cashewnut, indigo and papaya, the area and outturn figures are available in the publication 'Area and Outturn of Principal Crops in India', but with a time lag of one year. Therefore, estimates for the current year for these crops are based on projections, which are subsequently revised when the information is available.

Apart from the DESAg, Central Statistical Organization (CSO) and National Sample Survey Organization (NSSO) under the Ministry of Statistics and Programme Implementation, and Directorate General of Commercial Intelligence and Services (DGCIS) under the Ministry of

⁷ Agricultural crop year in India runs from July to June. There are two major crop seasons in India: the crops sown during the months of June to September are known as *kharif* (*kharif* means autumn in Arabic) crops and those during October to February as *rabi* (*rabi* means spring in Arabic) crops. Besides the two, *zaid* crops comprising vegetables and inferior cereals are grown in some parts of the country. *Zaid* crops are sown usually after the *rabi* harvesting is done and are ready for reaping before the *kharif* sowing season.

Commerce and Industry are important sources of information on statistics on agriculture in India. The CSO is responsible for managing National Accounts Statistics and also compiles data on crop production and, livestock and fisheries. The NSSO specializes in designing of surveys, carrying out field work, processing and dissemination of the data. It has dedicated divisions for each of these activities. The Fields Operations Division of the NSSO also provides technical guidance to the States/ UTs in Crops Estimation Surveys for the purpose of yield estimation.

II. Evolution of NAS in India and Embedment of the Agricultural Sector

II.1 NAS in India

Indian statisticians were instrumental in development of the first UN system of National Accounts in 1953 and also at the subsequent stages (Lequiller and Blades 2006, p. 385). This is probably one reason why India's national accounts have closely followed the recommendations of the successive versions of the System of National Accounts (SNA) – while concepts and methodology used for compilation is that of SNA, some procedures and approximations are constrained by the data collection system of the country. The Central Statistical Organization (CSO), once a while, revises the base year in order to address the methodological changes and incorporate data from new surveys and censuses. This helps in making the estimates suitable for international comparisons.

First systematic attempt towards generating official estimates of national income and other macro aggregates was setting up of an Expert Committee by the Government of India in 1949 under the chairmanship of Prof P C Mahalanobis with Profs D R Gadgil and V K R V Rao as members. The Committee recommended preparation of the national income estimates on an annual basis. The details comprising the methodology and estimates were first published by the Government in 1951. Later, the work of estimation was transferred to the CSO where a separate National Income Division was set up. Prior to independence (year 1947) too, many academicians and researchers tried to work out the national income estimates.

First official estimates were prepared with base year 1948-49 as per the methodology recommended by the Committee and continued till 1956. Over time availability of more basic

led to review of the methodology used and after a seminar and a series of follow up studies, the base year was revised to 1960-61. The coverage of NAS was extended to include estimates of capital formation and savings. The base years were subsequently revised from 1960-61 to 1970-71 and from 1970-71 to 1980-81. While in the former case, scope, coverage and methodology remained same; methodology used for estimation of fixed capital in the 1970-71 series was revised in 1980-81 series. Also, the state of Sikkim was also included. The 1980-81 series continue to provide estimates till 1999. Thus, prior to 1999, the base years for computation of NAS were revised decennially thrice, every time the base year was synchronized with the year of decennial Population Census, which usually is conducted in the years ending with 1. This was because the workforce estimates were obtained from the Population Census.

In 1999, the CSO revised the 1980-81 series with series having 1993-94 as base year. For the first time, Population Census was not used to obtain information on the workforce for the purpose of the national accounts since it was believed that the NSSO data captures the workforce participation rate better than the Population Census and thus it was decided to use the same from the NSSO 50th round (EUS), conducted in 1993-94, accordingly the base year too became 1993-94.⁸ Apart from this, the 1993-94 series also **for the first time** used the database on horticultural statistics (released by the National Horticulture Board of the Ministry of Agriculture). Coverage of agriculture was extended to include production in the fore/backyard, floriculture and deep sea fishing. Several other changes, especially related to services sector output, were made to comply with the recommendation of 1993 SNA. The 1993-94 series continued to provide estimates till 2006 when the CSO revised the base year to 1999-00. The practice of using the workforce estimates from the EUS of NSSO (conducted in the same year) instead of those from the Population Census continued in the current series (base year 1999-00).⁹ The changes in coverage and methodology of NAS with regards to the agriculture sector, incorporated in the current series are, discussed in one of the next sections.

⁸ The estimates of working population were believed to be under-enumerated in the population censuses.

⁹ A report by EPW Research Foundation (2002) mentions about the CSO's decision to revise the base year once in every five years to capture rapidly changing structural features of the economy.

Besides, the compilation of National Accounts Statistics involves several layers of approximations at various stages. Whether these approximations are reasonable and whether they make realistic assumptions are some of the pertinent questions. One of the famous Indian economists in reference to the reliability issue of the data set and the analysis based on that once commented that it is ‘garbage in and garbage out’. The expression does have validity because if the quality of data is poor then several of the issues that we have been analyzing and debating and the policy conclusions that we are deriving indeed deserve much less space and attention.

II.2 NAS and Agriculture in India

In the national accounts statistics, the agriculture sector includes agriculture proper, livestock (and livestock products), and operation of irrigation system. The agriculture proper includes growing various crops including plantation crops, agricultural and horticultural services and ancillary activities like gur making, transportation of produce to the primary markets and activities yielding rental income from farm buildings and machinery, etc. The livestock covers breeding and rearing of animals and poultry, production of milk, slaughtering, preparation and dressing of meat, production of raw hides and skins, eggs, dung, raw wool, honey, silk worm cocoons and increment in livestock. Operation of irrigation system comprises supply of water through various Government channels to the agriculturists. Often, agriculture and livestock activities go together and it may not always be feasible to segregate the various inputs into those used in agricultural and livestock production.

Until revision of the base year to 1993-94, when several recommendation of the 1993 SNA were incorporated, the GDP from the agricultural sector was underestimated on the following counts (Asthana 1998, as cited in EPW Research Foundation 2002): (i) omission of produces in floriculture, mushrooms and high value crops, (ii) underestimation of production of fruits and vegetables, spices and livestock products – in some cases, value of the reported production was even lower than that of their exports, (iii) the area sown under third and fourth crops (for instance in *zaid* season) in some states, (iv) under estimation of area under different crops (revealed in the ICS), and (v) price data supplied by the states.

In the year 2006, when the estimates were revised to the base year was changed to 1999-2000, the coverage of the GDP estimates were extended to include production of the following (under Agriculture and Allied Activities): (i) salt through seawater evaporation, (ii) betel leaves (for States of Assam & West Bengal), (iii) toddy, (iv) goat milk (in 16 States/UTs), buffalo milk (in 5 States/UTs) and camel milk having economic value and not presently covered in the production data, (v) duck eggs (in 15 States/UTs), and (vi) meat production from unregistered slaughtering in the States where the same is presently not covered in the production estimates (Govt. of India 2007, p. 4). In addition an important changes made in procedures of compilation in the new series is to utilize the production data provided by the National Horticulture Board (NHB) for all horticultural crops (with the exception of those covered under principal crops) and the price data provided by the State Directorates of Economics and Statistics (State DESs) for all crops.

II.3 Agriculture in present system of NAS

As mentioned earlier, 'Agriculture and Allied Activities' in the NAS include agriculture proper, livestock and livestock products and operation of irrigation systems. Before we discuss each of the three separately, it is important to note that the production approach is used to estimate contribution of the agriculture proper and livestock and livestock products to GDP in terms of the gross value added (GVA) whereas the same for operation of irrigation systems by government sources is estimated using the income approach. The GVA is difference between the value of products, by-products and ancillary activities at the prices received by the producers and the value of inputs to the process of production (raw materials and services) at purchasers' prices.

(i) Agriculture Proper: valuing the output

For the purpose of valuation in NAS, agricultural crops are divided into 11 groups - first ten are crop groups and the eleventh group comprise of by-products of the crops covered under the ten crop groups like *gur* production and bagasse (these activities are performed in farms),

and crop remnants like straw, stalks and sticks.¹⁰ Table -1 summarizes these groups, the sources of the data and the methodology used for valuation of output in the national accounts.

In the case of sugarcane, outturn excluding the quantity converted into *gur* by the cane growers is taken and *gur* is evaluated separately. Thus, total sugarcane production is divided into two parts: sugarcane utilized as such and the sugarcane converted into *gur*. While the former is evaluated at sugarcane prices, the latter is evaluated at corresponding *gur* prices. Estimates of *gur* production are not directly available and are built up using information on different uses of sugarcane – on average; amount of *gur* produced is 9 to 10 per cent of that of sugarcane used for *gur* making. Bagasse is obtained as a by-product during conversion of sugarcane into *gur* and in the present series (1999-00 base year); its production is taken to be 35 per cent of *gur* production. Besides its use in the production of the *gur* and crystal sugar, sugarcane is also used for production of *khandsari*, *bura* etc, in India. The consumption of sugarcane for producing *khandsari*, *bura* etc, is obtained from the data for registered and unregistered establishments.¹¹

Unlike the *gur* processing of tea is an activity outside the scope of agriculture. Hence, the output of raw tea leaves alone needs to be accounted for in the agriculture sector and this is taken to be equal to the input of raw tea leaf in the tea processing industry. Such information is available from the Annual Survey of Industries (ASI), in absence of which the production of tea leaves is estimated to be 4.44 times of the processed tea by the Tea Board on the basis of Techno-Economic Surveys. Information on area and outturn of opium is obtained from Central Bureau of Narcotics and that for other plantation crops are obtained from respective commodity boards.

Toddy crop is used to prepare a beverage consumed mainly in southern parts of the country. Its value is estimated by multiplying the value of Toddy consumption, obtained from a

¹⁰ The DESAg classifies 42 agricultural crops into two groups: Major and Minor crops, former comprises 25 crops and the later 17. It is these 42 crops that are divided into ten crop groups in the NAS.

¹¹ The quantity of sugarcane left over after allowing for its uses in the above activities is assumed to be converted into *gur*.

quinquennial survey on consumption conducted by the NSSO in 1999-2000, by the corresponding population separately for rural and urban areas of a state.

Production of crops in foreyard/backyard of houses was taken into account for the first time in the national accounts in the 1993-94 series based on a Survey on 'Livestock and Operational Land Holdings' carried out by the NSSO in 1991-92. Separate information on 'agricultural production in homestead only' and 'outside homestead raising field crops' was included for broad size class of operational holdings. Appropriate adjustments were made in the data to account for the residential building, which was part of the item in the survey giving information on operational holdings. The value of output on account of production of crops in foreyard/backyard was estimated using these area estimates and the value per hectare of fruits and vegetable crops. Note however that the survey was conducted only in rural areas.

(ii) Livestock and livestock products: valuing the output

The livestock and related products are classified into 7 broad groups for the purpose of valuation of output into the national accounts. Table – 2 summarizes the groups, their coverage, sources of information and briefly mentions the methodology used for the valuation of output.

(iii) Agriculture and livestock: valuing the inputs

Since it is difficult to apportion the inputs used for agriculture proper and that by the livestock used for agricultural purposes, the two are estimated together. The various items considered as items of intermediate consumption, are grouped into eleven categories. We discuss them in Table-3.

(iv) Irrigation systems

Unlike the case for most of the agriculture proper and the livestock discussed above, which by and large are unorganized, it is easier to estimate the contribution of irrigation systems (by the governments) in the national accounts and this is done using the income approach. The income approach involves summing the factor incomes accruing from production of an

activity. Estimates for the irrigation systems are prepared based on the data available in budget documents and the annual reports of Non-departmental Commercial Undertakings.¹²

III. NAS and the Agricultural Sector: Some Issues

This section discusses some of the problems related to database and the methodology, used to estimate contribution of the agriculture and allied activities to the national accounts. Such problems lead to under- and over-estimation of contributions of sub-components of the agriculture sector to the national income.

III.1 Data gaps

Several new entrepreneurial activities in the agriculture sector like mushroom cultivation, etc, have been taken up in the economy, in recent years (Kulshreshtha, Kolli and Singh 1997). Unfortunately, the production estimates of these relatively new activities are not available. CSO itself acknowledges that reliable estimates of many activities including the banned activities like hunting, trapping and game propagation are not available and the available data yields insignificant estimates of such activities (Govt of India 2007).

Since most of the agriculture production in India takes place in unorganized sector, many such units (including slaughter houses for the livestock) are not registered. Hence, it is likely that the existing methods and database underestimate the true contribution of agricultural sector in the GDP.

In respect of minor crops such as mango, citrus fruits and grapes, the estimates of area under these crops are available from the DESAg, but estimates of yield are not available. For these crops, the estimates of production are built up from the yield rates available from various reports of the Directorate of Marketing and Inspection (DMI) and state agricultural departments (Kulshreshtha, Kolli and Singh 1997). A central scheme, 'Scheme for crop estimation surveys on fruits and vegetables and minor crops', is also being implemented by some states.

¹² Note that the provision of irrigation systems, though owned, controlled and run by the government sector, is referred to as 'Departmental Commercial Undertaking' since the good/ service provided is chargeable and commercial accounting methods are used to determine profit and loss account.

III.2 Data Quality

Many censuses and surveys used for the above are not conducted on annual basis and thus require interpolation to bridge the data gaps. For instance, annual data on livestock population is estimated using inter-censal growth rates. Such growth rates may not take into the conditions, such as drought, floods, etc. prevailing in either of the census years.

Further in many areas, it is not possible to conduct the rigorous surveys due to such problems as difficult terrain and unfavorable political and social conditions. In such states, mostly ad-hoc methods are used. For instance, acreage estimation in Assam is based on ad-hoc methods.

III.3 Inter-temporal Comparability

The difficulty, which is encountered in a typical time series analysis, relates to the changes in methodology adopted in measuring value added. For example, in the Indian context the gross state domestic product (GSDP) figures at the state level taken from the CSO are available for two time periods: at 1980-81 prices the series is available for the period 1980-81 through 1997-98 and at 1993-94 prices for 1993-94 through 2003-04 (CSO 2003). The problem with the two series is that they differ not only in terms of prices but also coverage or the sectoral composition. Apart from changes in the database and improvements in methodology including those based on the 1993 UN SNA, several new activities across sectors have been included in the series based on 1993-94 prices. Hence, construction of an extended series starting from 1980-81 till date (at 1993-94 prices) involves serious limitations. The usual method to construct a continuous series is the simple splicing method, though the reliability is questionable because of the differences in sectoral coverage and change in the methodology as mentioned above. From the series made available by the CSO it is difficult to gauge if revisions could be carried out while converting the series based on the 1980-81 prices into 1993-94 prices. At the national level, it is, however, claimed that the series starting from 1950-51 to 1999-00 is based on the revised national income and production statistics linked back with 1999-00 as the base year, thus reworking the previous estimates applying the splicing technique to each activity independently (Govt. of India 2008, also see 'Preface to the

Fourth Edition' in EPW Research Foundation 20002). But from the above statement we are still not clear if the new methodology could be actually applied for the years prior to 1980-81.

Again, for the recent years from 1999-2000 to 2006-07 the base of GDP has been changed to 1999-2000. However the sectoral distributions of GDP from two different series (at 1993-94 prices and 1999-2000 prices) for the year 2000-01 are quite similar. Hence, percentage figures and growth rates based on these two series may be broadly comparable. On the whole, one may conclude that national income estimates are possibly tending to converge with the methodology suggested by UN SNA and therefore, the comparability problem is on the decline.

III.4 Regional Accounts

At present, the geographical unit for compilation of the data is the states. Large intra-state variations in India are well known (there is extensive literature on intra-state disparity in income, poverty and other social outcomes; and interdependence between agriculture and these indicators of development too is well known). Such variations mean district level data becomes important for decisions making at a sub-national level. Such a data also helps us understand the transactions taking place in the regional economy. In this connection, a CSO Working group established in 1957 recommended 'Farm Management Studies' for improving the inputs' data. Later, in 1971 and 1975 Working Group on Regional Level Statistics were constituted who recommended development of strong infrastructure for collecting statistics at the District and lower level organizations. A 1972 RAC recommended a System of Regional Accounts (SRA). But this Committee could not submit a set of regional accounts due to conceptual and data problems, in particular those related to the treatment of savings, change in stocks and external trade.

III.5 Other Methodological Challenges

A more serious problem relates to the differences in income estimation across sectors. Hence the aggregation which is carried out to arrive at the total GDP figures may not be reliable at all. For example, in the context of the tertiary sector there does not exist any uniform definition. Transport storage and communication constituting the basic infrastructure are as

good as the manufacturing activities. But the measurement of value added and its interpretation in certain components of the tertiary sector like trade, hotels and restaurants and community, social and personal services cannot be done as that in agriculture or manufacturing. The rise in real income of employees engaged in some of these activities cannot necessarily be treated as the rise in value addition made by them because the rise could be completely independent of any change in the contribution made by the employees. The rise in value added originating from the trade sector can be merely a rise in the mark-up, without any reference to the actual value addition or the productive capacity of the economy. This problem can be there in manufacturing as well. But there is a difference between the manufacturing and services sector in this respect. Large manufacturing firms may be exploiting monopoly power and raising the markups, but this problem can be overcome if we estimate value addition in terms of factor cost instead of market prices.

The other issue relates to the situation in which certain service related activities within manufacturing or agriculture are moving out to gain their own identity. These activities were counted earlier as part of the manufacturing or agriculture activities, and because of super-specialisation these activities now fall into the domain of the tertiary sector. This may mean a sudden rise in the share of the tertiary sector in total value added for the recent years while in the past they remained embedded in other sectors¹³. All this entails problems of comparability of sectoral shares over time.

For the IT sector also there is no uniform definition because the concepts, methods and applications involved are constantly evolving almost every day. In India, it covers one particular sub-sector – software and IT enabled services - which employ a substantial proportion of the total employment in the ICT sector in the country while in some other countries it encompasses communication and hardware sectors (Sarkar and Mehta, 2006).

Besides, value added originating from some of the activities within the tertiary sector is not captured appropriately. Transport of goods, television serials and film production and

¹³ Banga and Goldar (2004) in fact bring out distinctly that service as an input to manufacturing production increased in the recent years.

advertisements are only a few examples of such activities. Keeping these limitations in view it will not be erroneous to treat national accounts estimates in the Indian context to be a peculiar hotchpotch if value added from agriculture is to be integrated with the value added originating from other sectors . The approximations at the most are unreasonable compromises. With methodological advancements and wider applications of technological skill in collecting and maintaining information the database for the agriculture sector can be expected to acquire greater comparability from an international point of view.

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Table 1: Agriculture proper in the NAS: valuation of output

S No	Group	Coverage/ Definition	Notes on methodology for valuation for the purpose of the national accounts
(i)	Cereals	Paddy, Wheat, Jowar, Bajra, Barley, Maize, Ragi & Small Millets, and other cereals	Acreage and yield based on sources discussed in Section I.3
(ii)	Pulses	Gram, Moong, Tur, Moth, Horse Gram, Masoor, Urad, other pulses and peas	See Section I.3
(iii)	Oil seeds	Linseed, Groundnut, Rapeseed and Mustard, Sesamum, Castor seed, Coconut, Safflower, Niger seed, Soyabean	See Section I.3
(iv)	Sugar	Sugarcane, Gur, Palmyra sugar, other sugar	See I.3; II.3(i) for <i>Gur</i> and other sugars
(v)	Fibers	Kapas, Jute, Sunhemp, Mesta, other fibres	See Section I.3
(vi)	Drugs and Narcotics	Tobacco, Tea, Coffee, Opium, Betel leaves, Isabgol, Saffron, Coca, other drugs and narcotics	See Section II.3(i)
(vii)	Dyes and Tanning	Indigo, other dyes and tanning material	Production and Prices: State DES of Tamil Nadu and Rajasthan; Area: LUS
(viii)	Condiments and Spices	Cardamom, Dry chilies, Black pepper, Dry ginger, Turmeric, Garlic, Fennel, Cumin, Ajwain, Methi, Tamarind, Nutmeg, Cloves, Cinnamon, Coriander, Arecanut, and other condiments and spices	See Section I.3
(ix)	Fruits and vegetables	Banana, Mango, Grapes, Cashewnut, Papaya, Apple, Mosambi, Lemon, Orange, Lichi, Pineapple, Sapota, Guava, Potato, Sweet potato, Tapioca, Brinjal, Cabbage, Cauliflower, Okra, Tomato, Green peas, other vegetables, Onion, Cherry, Almonds, Walnut, Pear other temperate fruits, Subtropical fruits, Other citrus fruits, Jack fruit, Drumstick, floriculture, backyard farming	See Section I.3, 'Indian Horticulture Database' of National Horticulture Board, NSSO for backyard farming (Section II.3)
(x)	Miscellaneous crops	Rubber, Fodder, Mulberry, Guar Seed, Grass, miscellaneous food and non-food crops	Output estimates based on average yield per hectare on the area from LUS
(xi)	By-products	Straw, Stalks and sticks of cereals and pulses cane trash, bagasse, and poppy seed and husk	CCS (Section I.3), Section II.3(i)

Note: (i) Data releasing agency is DESAg and original sources are LUS, Area and Outturn of Principal Crops, and the CCS (see section I.3 for details); (ii) Prices used for evaluation are based on States DES (Directorate of Economics and Statistics) of the state governments.

Source: Compilation based on Chapter 9 in Govt. of India (2007).

Table 2: Livestock and livestock products in the NAS: valuation of output

S No	Group	Coverage/ Definition	Data releasing agency	Original source/ survey	Notes on methodology for valuation for the purpose of the national accounts
(i)	Milk	Milk consumed or sold in fluid form, ghee, butter and <i>lassi</i>	DAHDF	ISS	Milk production estimates from DAHDF; If unavailable for a state, then based on yield rates prevailing in neighboring states
(ii)	Meat	Meat, meat products, and by-products comprising hides, skins and other products	CSO	Slaughter houses in states	Meat: total production of meat, estimated by the states, from registered and unregistered slaughterhouses; Meat products and by-products: estimates based on the no of slaughtered and fallen animals, and the corresponding yield rates
(iii)	Eggs	Eggs	DAHDF	ISS, IASRI and SAHD surveys	Poultry meat: number of adult fowls, chickens and ducklings slaughtered
(iv)	Wool and Hair	Wool from sheep and hair from camels, goats and pigs	CSO	CSO studies, ISS	Average yield rates (quantity in grams or kgs/animal/year) from camels and pigs
(v)	Dung	Dung – fuel and manure	DAHDF	ISS	Production: population and evacuation rates; Utilization rates: Manure and fuel
(vi)	Silk worm cocoons and honey	Silk worm by types and honey	CSB, KVIC	CSB, KVIC	Production: outturn estimates of silk worm cocoons by types and honey
(vii)	Increment in Livestock	Change in the population for each category of livestock	DAHDF	Livestock census	Projections on the basis of growth rates observed between the last two Livestock Censuses

Notes: (i) Acronyms - DAHDF: Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture; KVIC: Khadi and Village Industrial Commission; SAHD: State Animal Husbandry Departments, ISS: Integrated Sample Surveys, CSB: Central Silk Board. (ii) Prices used for evaluation are based on States Directorate of Economics and Statistics of the state governments.

Source: Compilation based on Chapter 9 in Govt. of India (2007).

Table 3: Agriculture Proper and livestock in national accounts: valuing the inputs

S No	Input	Coverage/ Definition	Data releasing agency	Original source	Notes on methodology
(i)	Seed	Seeds used as input	DESAg, SADs	CCS	Value of seeds used as inputs is price times area times seed rates; price same as that used for output
(ii)	Organic manure	Dung, other than that used for making dung cakes for fuel	DAHDF	ISS	It is assumed that output of dung, other than that used for making dung cakes for fuel, of the animal husbandry is used as input in the agriculture sector.
(iii)	Chemical Fertilizer	Material wise consumption of chemical fertilizers	FAI	Producers	Consumption of chemical fertilizers is obtained from material wise distribution of chemical fertilizers to States by the Central Fertilizer Pool and other manufacturers. Fertilizers are evaluated at retail prices prevailing in the markets.
(iv)	Pesticides & Insecticides	Pesticides & Insecticides used as input	DPPQ	CCFI	Consumption of pesticides and insecticides times their cost at the national level
(v)	Irrigation Charges	Charges payable to the govt in lieu of the water supplied to the farmers from govt owned and other means of irrigation	DES's	Irrigation departments	State wise information on the (a) sale of water (for irrigation), (b) irrigation cess, (c) local cess, (d) betterment levy and other items. If this information is unavailable, estimates from budget documents are used which may include other receipts that are not a part of irrigation charges.
(vi)	Electricity	Electricity consumed for agricultural purposes	CEA		Electricity consumed for agricultural purposes times the corresponding price per unit.
(vii)	Market charges	Charges paid by the farmers to carry their produce to the markets	DESAg	Ad-hoc surveys	Separate charges for agriculture and livestock production. Percentage of market margins and market costs to the total value of output is 2.358 (1997-98).
(viii)	Diesel Oil	Consumption of diesel	IOC, ILC and CCS		Estimated based on number of tractors and diesel engines in use (obtained from ILC) and per unit consumption of diesel (data from CCS) and the prices of diesel from IOC.
(ix)	Repairs, maintenance & operation costs	Current repairs, Maintenance of fixed assets & Operation Cost	AIDIS	AIDIS	Data on expenditure on these items is collected

(x)	Feed of livestock	Two categories: (i) Roughages (trash, grass, fodder, straw etc) and (ii) Concentrates (oil cakes, crushed pulses, grains, medicines, salts etc)	DESAg, NSSO	For roughages, entire production of fodder, cane trash and grass and 95 per cent of production of stalks and straws in the agriculture sector are considered to be consumed by entire livestock population. An adjustment is made for the consumption of these items by animals which are mainly used for transportation purposes.
(xi)	FISIM	financial services indirectly measured	Banks and other financial institutions in the organized and unorganized sector	These are the output of financial intermediation for which no explicit information is available on the output; such output is imputed indirectly. Income approach is used.

Notes: SADs: State Agricultural Departments, FAI: Fertilizer Association of India, DPPQ: Directorate of Plant Protection and Quarantine, Ministry of Agriculture, CCFI: Crop Care Foundation of India (formerly Pesticides Association of India), IOC: Indian Oil Corporation Limited, ILC: Indian Livestock Census, AIDIS: All India Debt and Investment Survey

Sources: Compilation based on Chapters 9 and 18 in Govt. of India (2007).