

The Role of National Sample Survey Data in Compiling Indian National Accounts Statistics: Uses, Challenges and Enhancements

A.C. Kulshreshtha¹ and Gulab Singh²

¹Former ADG, CSO, MOSPI; and Faculty UNSIAP, Japan

²Former Director, CSO, MOSPI; and Senior Statistician,
United Nations Statistics Division,, New York, USA

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SUMMARY

This paper offers a detailed examination of the integral role played by National Sample Survey (NSS) data in the compilation of Indian National Accounts Statistics (NAS). Conducted by the National Sample Survey Office (NSSO), NSS surveys - such as the Household Consumption Expenditure Survey (HCES, formerly CES), Periodic Labour Force Survey (PLFS, succeeding EUS), Enterprise Surveys (ES), and All-India Debt and Investment Survey (AIDIS) - are essential for estimating key macroeconomic aggregates, including Gross Value Added (GVA), Private Final Consumption Expenditure (PFCE), Gross Capital Formation (GCF), and household savings, particularly within the informal sector that dominates India's economy. The analysis delineates methodologies like the LabourInput (LI) method, Effective LabourInput (ELI) method, and nested Cobb-Douglas production functions for deriving value added per worker (VAPW). It also addresses persistent challenges, including survey periodicity, coverage gaps, data discrepancies, and sampling errors, while proposing strategies for improvement, such as increased frequency, data harmonization, and integration with emerging data sources like Goods and Services Tax (GST) records and digital platforms. A case study on the 2011-12 base year revision illustrates NSS's practical impact, and recent developments, including the new surveys like the Annual Survey of Unincorporated Sector Enterprises (ASUSE) and HCES 2022-23, underscore its evolving relevance. Insights from seminal studies (e.g., Kulshreshtha *et al.*, 2002; Kulshreshtha and Singh, 1995; Kar *et al.*, 2003) are synthesized to provide a robust framework for policymakers, statisticians, and researchers aiming to refine NAS compilation in India and similar emerging economies.

JEL Classification Code: C80, E01, E21, O11

Keywords: National sample survey (NSS); National accounts statistics (NAS); Gross value added (GVA); Private final consumption expenditure (PFCE); Labour input method; Informal sector; Base year revision; Household consumption expenditure survey (HCES); Periodic labour force survey (PLFS); Enterprise surveys workforce participation rates.

Dr. Manindra Nath Das: A Tribute to a Visionary Statistician

I am grateful to the Indian Society of Agricultural Statistics (ISAS) for inviting me to contribute a paper for the special issue of the Journal of ISAS being brought out to commemorate the centenary celebrations of Late Professor MN Das. I happened to be in his first batch of research students. I am thankful to Almighty for providing me this opportunity to spend time with him that enabled me to imbibe few of his characteristics. He used to call me Kulshrestu. Dr. Das was my teacher, guide, mentor, philosopher and virtually everything throughout my association with him.

Anyone interested in agricultural statistics, in particular design of experiments knows that Dr. Das was a prolific researcher with unparalleled intuition (Prof. R.C. Bose said once in a seminar that M.N. Das was the only one in IARS who had intuition). Many of his research findings were given mathematical rigour later by his students. Undoubtedly, Dr. Das was an outstanding researcher with many brilliant original contributions; he was also an excellent teacher and mentor to more than 30 Ph.D. students. Beside contributing to construction of Incomplete Block Designs, he also contributed to Bio-assay Designs, Sample Survey Designs, Error Correcting Codes, and Computer Applications. Couple of his students worked in Sample Surveys for their Ph.D. He encouraged me to write research papers in the official statistics, particularly National Accounts and Input-Output Tables, construction, and applications. Today for a change to offer a tribute to the visionary Statistician, I dare to write on the use of National Sample Survey Data in National Accounts Statistics, rather than my favourite topic Bio-assay designs.

Corresponding author: A.C. Kulshreshtha
E-mail address: ackulshreshtha@yahoo.com

1. INTRODUCTION

National Accounts Statistics (NAS) form the backbone of economic analysis, providing a quantitative framework to measure a country's economic performance through indicators like Gross/Net Domestic Product (G/NDP), Gross/Net Value Added (G/NVA), Private Final Consumption Expenditure (PFCE) Gross Capital Formation (GCF) and Savings. In India, where the informal sector constitutes a significant portion of the economy, the National Sample Surveys (NSS), conducted by the National Sample Survey Office (NSSO), plays a pivotal role in filling data gaps where administrative records are limited. Initiated in 1950, NSS employ a stratified multi-stage sampling design to collect socio-economic data across rural and urban areas, making it indispensable for NAS compilation. This paper deliberates on the use of NSS data in NAS, integrating insights from select key studies made earlier (*cf.*, Kulshreshtha, and Singh, 1995; Kulshreshtha *et al.*, 2002; Kar *et al.*, 2003). It recounts how NSS surveys, including Consumer Expenditure Surveys (CES), Employment and Unemployment Survey/Periodic Labor Force Survey (EUS/PLFS), Enterprise Surveys (ES), and Annual Surveys of Unincorporated Sector Enterprises (ASUSE) contribute to estimating economic aggregates, details the methodologies involved, and addresses challenges such as infrequent surveys, coverage gaps, and data validation issues. Strategies to enhance data utilization, a case study on the 2011-12 base year revision exercises, and recent developments are also discussed. The paper aims to provide a comprehensive resource for policymakers, statisticians, and researchers seeking to understand and appreciate the NAS compilation issues in India.

This paper is organized as follows. Section 1 introduces the importance of NSS data in addressing data gaps in India's informal sector-dominated economy. Provides context for why NSS data is indispensable for NAS, especially for readers unfamiliar with India's statistical system. Section 2 outlines the currently used framework of NAS and its reliance on NSS data for the informal/unorganized sector. It elaborates the structure of NAS and depicts how NSS fills the data gaps, providing a foundation for understanding subsequent sections. A brief description of NAS key aggregates is provided to better appreciate the use of NSS results in compilation of these and related indicators. Section

3 details the NSS's structure, sampling methodology, and key surveys relevant to NAS which is essential for understanding the data sources and their statistical rigor, particularly for statistician's familiar with survey methodologies. Section 4 explains how NSS data is applied to estimate specific NAS components like GVA using labor input (LI) and effective labor input (ELI) method, PFCE, capital formation and saving, Supply-Use Tables and Regional Accounts, etc. Section 5 describes the methodological framework of integrating NSS data into NAS. Section 6 indicates challenges and identifies limitations in NSS data and their impact on NAS accuracy. Section 7 proposes solutions to address challenges in using the NSS data for NAS compilation. Section 8 illustrates NSS's role and real-world example of NSS data application in a NAS 2011-12 base year revision exercise. Section 9 highlights ongoing improvements and future plans for NSS in NAS compilation highlighting the evolving role of NSS, relevant for readers interested in future statistical advancements. Finally, Section 10 summarizes the NSS's critical role and its future potential in enhancing the coverage and consistency of the NAS.

2. FRAMEWORK OF NATIONAL ACCOUNTS STATISTICS (NAS)

The National Statistics Office (NSO), earlier known as Central Statistical Office (CSO) has been compiling and publishing the official estimates of Gross Domestic Product (GDP) and related macro-economic aggregates annually since the early fifties. The quality and coverage of these estimates have improved with the development of the statistical system, though, a substantial portion of the estimate of aggregate GDP of a particular year, is based on projections and benchmark estimates owing to absence of direct current information, especially in the unorganized/ informal segment of the economy. However, the use of projections and benchmark estimates has come down progressively over successive base revisions since the early phases of compilation to the present (2011-12) base year Series. The NAS encompasses a set of macroeconomic indicators that measure economic activity, adhering to the System of National Accounts (SNA) framework.

The SNA serves as the internationally agreed-upon statistical framework that provides countries with standardized guidelines for compiling national

accounts statistics, ensuring consistency, comparability, and reliability in measuring economic activities across borders. Developed collaboratively by international organizations such as the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development, World Bank, and Eurostat, the SNA outlines comprehensive methodologies for calculating key macroeconomic aggregates like GDP, GVA, final consumption expenditure, gross capital formation, and savings through integrated production, expenditure, and income approaches. This framework not only facilitates economic analysis, policymaking, and forecasting by offering a flexible structure adaptable to national contexts but also promotes global harmonization, with the latest update, 2025 SNA, released in March 2025. This paper however at present does not address the challenges posed by the changes made in the latest update of the SNA (2025 SNA) incorporating advancements in digital economies, environmental accounting, and globalization impacts to better reflect contemporary economic realities.

The key macroeconomic aggregates comprising the “current series of NAS” include:

- **Gross Domestic Product (GDP):** GDP is defined as the total unduplicated value of production within the economic territory during an accounting period. There are three approaches of its measurement, viz.:

- Production Measure:* Gross Value Added (GVA): GVA is defined as the value of output less the value of intermediate consumption, measuring the contribution to GDP made by an individual producer, industry, or sector.

The value of output minus intermediate consumption, aggregated across sectors,

$$\sum \text{GVA} + \text{taxes on products} - \text{subsidies on products} = \text{GDP}$$

($\sum$ indicates the summation of value added by all economic activities undertaken in the economy).

$$\sum \text{GVA} = \text{GDP} - \text{taxes on products} + \text{subsidies on products}$$

Output less intermediate consumption plus taxes less subsidies on products (This is the sum of gross value added of all industry groups, plus

taxes less subsidies on all products including imports).

- Expenditure Measure:* Sum of Final Consumption Expenditures (Households, Non-Profit Institutions serving Households, and Government), Gross Capital Formation (Gross Fixed Capital Formation, Change in Stocks and Valuables), exports, minus imports. This reflects how the economy's output is used.
 - Income Measure:* Compensation of employees, gross operating surplus, gross mixed income, plus taxes less subsidies on production. This captures the income generated from production. Taxes less subsidies on products are to be added to get GDP, which is always at market prices.
- **Private Final Consumption Expenditure (PFCE):** Private final consumption expenditure (PFCE) includes final consumption expenditure of (a) Households and (b) Non-profit institutions serving households (NPISH) like religious and charitable institutions. The final consumption expenditure of households relates to outlays on new durable as well as nondurable goods (except building and land) and on services evaluated at purchaser's prices. This consumption expenditure also includes the imputed gross rent of owneroccupied dwellings, consumption of own-account production evaluated at producers' prices and payments in kind of wages and salaries valued at cost, e.g., provision for food, shelter and clothing to the employees. The final consumption expenditure of nonprofit institutions serving households includes the value of goods and services produced for own use on current account i.e., the value of gross output reduced by the sum of the value of their commodity and noncommodity sales. This PFCE of both Households and NPISH would include transfers in kind of nondurable goods and services (consumables) from Government Administration, industries, and rest of the world. The bicycles, which are given to the school going girls from the government should be treated as current transfer.
 - **Gross Capital Formation (GCF):** Gross Capital Formation (GCF) is defined as the total value of acquisitions, less disposals, of fixed assets during an accounting period, plus certain additions to

the value of non-produced assets (such as land improvements or major improvements to existing assets) and the costs associated with ownership transfer of these assets. It represents the investment in assets that contribute to future production. Its key component include:

1. *Gross Fixed Capital Formation (GFCF):*

- Acquisitions (less disposals) of fixed assets, which include tangible assets (e.g., buildings, machinery, equipment, vehicles) and intangible assets (e.g., software, intellectual property products like research and development).
- Includes improvements to existing fixed assets that extend their life or increase their productive capacity.
- Excludes routine maintenance and repairs.

2. *Changes in Inventories:*

- The value of the net change in inventories of raw materials, work-in-progress, and finished goods held by producers. This includes materials held for production and goods awaiting sale.

3. *Acquisitions less disposals of valuables:*

- Valuables such as precious metals, antiques, or art objects acquired primarily as stores of value rather than for production or consumption.

4. *Additions to non-produced assets:*

- Major improvements to non-produced assets (e.g., land reclamation, forest clearing) and costs of ownership transfer (e.g., legal fees, taxes) on non-produced assets like land or patented entities.

- **Saving:** saving is defined as the portion of disposable income (or net disposable income for institutional sectors) that is not spent on final consumption expenditure. It represents the residual amount available for investment in financial or non-financial assets, debt repayment, or accumulation of wealth after accounting for consumption.

- $\text{Saving} = \text{Disposable Income} - \text{Final Consumption Expenditure}.$

- For households, disposable income includes primary income from wages, property, current transfers, and other sources, minus taxes and other compulsory payments.
- For other institutional sectors (e.g., corporations, government), it is similarly derived from their respective income and consumption accounts.
- Saving is recorded in the capital account of the national accounts, as it finances gross capital formation (investment in fixed assets, inventories, and valuables) or net lending/borrowing.
- It is a key balancing item in the use of disposable income account, bridging current transactions (income and consumption) with capital transactions (investment and lending).
- Saving can be positive (when income exceeds consumption) or negative (when consumption exceeds income, implying borrowing or asset drawdown).
- For households, saving includes amounts set aside for future consumption, investment in assets (e.g., housing, financial securities), or precautionary purposes.
- For corporations, saving is often referred to as retained earnings, reflecting profits not distributed as dividends.
- In the context of national accounts, saving is a critical indicator of an economy's capacity to finance investment internally or contribute to net lending to other sectors or economies.

NAS is compiled using the three approaches, production, income, and expenditure, each requiring specific data sources. The NSO oversees the NAS compilation, integrating data from administrative records, surveys, and censuses. The informal sector, which accounts for a significant share of economic activity, poses challenges due to limited administrative data, making NSS surveys critical (Ministry of Statistics and Programme Implementation, 2012).

From the viewpoint of availability of data required for compiling national income and related aggregates, the economy can be broadly divided into three segments, viz. public, private organized (comprising mainly joint stock companies and cooperatives) and private unorganized. The term organized sector is

generally referred to units whose annual accounts are available. The public and private organized segments are taken to constitute the organized segment in the Indian System of National Accounts. As regards the public sector, complete information is available through the budget documents and audited annual accounts (Profit and Loss Accounts and Balance Sheet) of the public sector enterprises. The information relating to the private organized segment is available annually from sources like Annual Survey of Industries (ASI) and the Ministry of Corporate Affairs (MCA). It is the unorganized (or informal, approximately) segment of the economy for which there is no regular flow of data, either from official sources or through annual surveys. Using the Economic Census data as *Frame*, a system of conducting Enterprise Surveys (ESs) was in fact instituted in 1980's to fill this huge data gap and to help generate benchmark estimates for national accounts at regular intervals. For subsequent years, the estimates of income generated in the unorganized segments of the manufacturing and service sectors are, arrived at by moving the benchmark estimates with the help of physical indicators.

Adoption of 'production approach' is not feasible for the economic activities undertaken in the unorganized/ informal segment of the economy for want of requisite data on output and intermediate consumption each year. Instead, the Gross Value Added (GVA) from these activities are estimated by what is referred to in the literature as 'income approach' or 'labor input method', which requires the estimates of workforce engaged in the respective economic activities and the corresponding estimates of 'gross value added per worker (GVAPW)'. The estimates of GVAPW are obtained from the ESs on various economic activities, which have been conducted periodically by the NSSO.

The services sector comprises activities like trade, hotels and restaurants, transport, storage, financial services like banking and insurance, business services, and community, social and personal services. A large part of the economic activities providing these services is carried out in the unorganized segment of the economy. In fact, the official estimates of sectoral distribution of GDP indicate that more than half of the income generated in the service sector comes from the economic activities carried out in the unorganized segment of the economy.

3. OVERVIEW OF NATIONAL SAMPLE SURVEY (NSS)

The NSS, established in 1950, is one of the oldest continuing household - sector enterprise sample surveys in the developing world. Administered by the NSSO under the Ministry of Statistics and Programme Implementation (MOSPI), it conducts large scale surveys on socio-economic topics using a stratified multi-stage sampling design to ensure coverage across rural and urban areas, States, and socio-economic groups.

The problem of building an adequate database for the unorganized segment of the non-agricultural sector has remained a matter of serious concern to the official statisticians since the formative days of the statistical system of the country. It may be mentioned that NSS survey results on household run non-agricultural enterprises have been used since the beginning. For example, the results of surveys of NSS 23rd (1968-69) and 29th (1973-74) rounds were used as benchmarks for 1970-71 series of the NAS (source: Sources and Methods). Such surveys were conducted even before the adoption of "Economic Census and Follow-up Surveys". To institute a system of regular data collection for this part of the economy, a scheme called "Economic Census and Follow-up Surveys" was evolved and implemented by the CSO in 1976. As envisaged, the Economic Census (EC) provided a sampling frame for the follow-up Enterprise Surveys (ESs), which were to be conducted using the techniques of survey sampling. Accordingly, the first EC was conducted in 1977 and was followed up by ES on Unorganized Manufacturing in 1978-79 and ESs on Trade, Hotels and Restaurants, Transport, Storage and Warehousing, and Services in 1979-80 (Kulshreshtha and Singh, 2002). Follow up Surveys have been conducted by the NSSO, since 1977. EC have since been conducted for the years 1977, 1980, 1990, 1998, 2005, and the Sixth EC in 2013. An EC was also conducted for the year 2019 by the Common Services Centre of the M/EIT but the data quality is still being examined. Follow-up surveys capturing the unorganized/informal sector have been conducted using these 2013 EC as Frame.

Conducted in rounds (annually or quinquennially), NSS surveys cover diverse topics: The "Economic

Census and Follow up surveys” relevant to NAS compilation include:

3.1 Consumer Expenditure Survey (CES)

CES is conducted by the NSSO under MOSPI, collects data on household consumption patterns to inform economic indicators like Private Final Consumption Expenditure (PFCE) and poverty estimates. It uses Stratified Multi-Stage Sampling design with rural and urban areas as strata. The sampling scheme for selection of First Stage Units (*FSUs*) comprise Villages (rural) and Urban Frame Survey blocks (Urban) has not been same in all rounds. At the Second Stage Units: Households within *FSUs*, selected randomly or systematically. Nationwide rural and urban areas across all States and union territories are covered. It covers all household types (except institutional households like hostels, barracks). Typically conducted quinquennially -every 5 years (e.g., NSS 68th Round, 2011–12; 75th Round, 2017–18). Now also the HCES for, 2022–23 and 2023–24. In past there were some annual thinner surveys in some cases.

Items of data collected include:

- *Consumption Expenditure*: Monthly expenditure on food (cereals, pulses, milk, etc.), non-food items (clothing, fuel, education, health), and durable goods (appliances, vehicles).
- *Demographic Details*: Household size, age, gender, occupation, and education of members.
- *Socio-Economic Indicators*: Income sources, housing conditions, and access to amenities (e.g., water, sanitation).
- *Quantity*: Quantities consumed (e.g., kg of rice) and expenditure values for key items.
- *Recall Period*: Varies (e.g., 7 days and 30 days for frequent items like food, 365 days for durables).

3.2 Employment and unemployment survey (EUS)/ periodic laborforce survey (PLFS)

The NSS Employment and Unemployment Survey (EUS), now integrated into the Periodic Labor Force Survey (PLFS) since 2017, conducted by the NSSO under MOSPI, collects data on employment, unemployment, and labor force characteristics in India

to support national accounts, policy planning, and labor market analysis.

The sampling design and the geographical coverage EUS/PLFS are the same as that of the CES. EUS used to be conducted quinquennially (e.g., NSS 55th Round, 1999–2000); PLFS is annual since 2017–18, with quarterly urban surveys.

Items of data collected include:

- *Labor Force Status*: Employment, unemployment, and out-of-labor-force status, based on usual status (past year) and current weekly/daily status.
- *Employment Details*: Industry, occupation, employment type (self-employed, regular, casual), hours worked, and earnings.
- *Unemployment Indicators*: Job search activities, duration of unemployment, and reasons for not working.
- *Demographic and Socio-Economic Data*: Age, gender, education, household size, and social group.
- *Additional Metrics (PLFS)*: Underemployment, informal sector employment, and multiple job holdings.

EUS and PLFS provide workforce estimates critical for the labor input method used to estimate GVA for unorganized sectors.

3.3 Enterprise surveys (ES)

The NSS’s ability to capture informal sector activities makes it indispensable for NAS. These surveys, rooted in robust statistical methodologies, are essential for capturing the informal sector and household-level economic activities, which dominate India’s economy.

The sampling design for ESs typically involves a stratified multi-stage approach, leveraging the EC as the sampling frame. The *FSUs* are selected as villages in rural areas and urban blocks in urban areas, based on the comprehensive listing from the EC. Within these *FSUs*, enterprises are listed and then sampled based on their size and type, categorized as follows:

- *Own Account Enterprises (OAE)*: Enterprises run without any hired workers.

- Non-Directory Establishments (NDE): Enterprises employing 1 to 5 workers, with at least one hired worker.
- Directory Establishments (DE): Enterprises employing 6 or more workers, with at least one hired worker.

The surveys aim to estimate parameters such as the number of enterprises, employment, gross value added per worker, and other economic indicators for these categories. The design ensures representativeness at the national and regional levels, with stratification based on geographic and economic characteristics.

Since, the estimate of workers from the enterprise surveys differ from that of the regular employment/unemployment surveys, these surveys are better at estimating ratios such as value added per worker, value added per enterprises etc. That is the reason value added per workers are derived from the enterprise surveys and labor input are derived from the employment and unemployment surveys. The GVAPW is estimated using the enterprise surveys data by dividing GVA by the number of workers. This estimated value of GVAPW is then used to obtain the Sectoral GVA = GVAPW (obtained from ES) $\times$ workforce (obtained from EUS/PLFS), (*cf.*, Kar *et al.*, 2003).

3.4 All India Debt and Investment Surveys (AIDIS)

The AIDIS conducted by the NSSO, provide critical data on household assets, liabilities, and capital expenditure, which are used in compiling Indian NAS. AIDIS is conducted decennially (*e.g.*, NSS 26th Round, 1971–72; 48th Round, 1992; 59th Round, 2003; 70th Round, 2013; 77th Round, 2019), with data collected in two visits for accuracy. The geographical coverage nationwide rural and urban households, excluding institutional households. Data collected include assets (land, buildings, financial instruments), liabilities (loans, debts), and capital expenditure (construction, equipment).

AIDIS focuses on household-level data, so its use in NAS is limited to the household and unorganized sectors. Corporate and government sector estimates rely on other sources (*e.g.*, MCA-21, budgets). The AIDIS data from the 70th Round (2013) informed savings estimate in the 2011-12 base year revision (MOSPI, 2015).

4. USE OF NSS DATA IN NAS COMPILATION

NSS data is integrated into NAS across multiple dimensions, with specific surveys contributing to different economic aggregates.

4.1 Private Final Consumption Expenditure (PFCE)

In the NAS, estimates of PFCE are obtained by following the commodity flow method, where total availability of a given item group (domestic production plus imports) is adjusted for intermediate consumption, government consumption, exports, changes in stocks, and investment, with the remainder attributed to private (household+NPISH) final consumption. The quantity of final consumption obtained from commodity balances is generally evaluated at market prices.

The CES data are used directly for estimating PFCE for items such as spices, salt, pan, and medical care, with per capita consumption values forming the basis for estimates (MOSPI, 2012). For example, in the 1993-94 CES, per capita expenditure on medical services informed PFCE estimates for health services. Factors affecting comparability of CES and PFCE amongst other things include non-profit institutions serving households (NPISHs) in PFCE but not in the CES. Exclusion of houseless and institutional populations in CES. Imputed rentals in PFCE versus actual rental in CES (MOSPI, 2023a). For PFCE, CES data is scaled and adjusted to align with the commodity flow approach, accounting for NPISHs and institutional populations (MOSPI, 2023a).

4.2 Gross Value Added (GVA)

The NSS data is crucial for estimating GVA, particularly in the informal sector using labor input method/income approach. The EUS and PLFS provide workforce estimates critical for the labor input method used to estimate GVA in unorganized sectors. The labor input method is a cornerstone for estimating GVA in unorganized sectors, involving:

- *Workforce Estimation:* Using EUS/PLFS data to estimate workers by sector, adjusted for rural/urban and gender differences.
- *VAPW Calculation:* Deriving GVAPW from ES, deflated to a base year using price indices.

- *GVA Computation:* Multiplying workforce by GVAPW: $GVA = \text{Workforce} \times VAPW$.

In the 2011-12 series, “Effective Labor Input Method” (ELI Method) has been used for the following enterprises (MOSPI, 2015).

- All unincorporated manufacturing enterprises, except those covered under the Annual Survey of Industries, and
- Unincorporated service enterprises, except those of ‘Trade and Repair Services’, ‘Accommodation and food service activities’, ‘Non-mechanized Road transport’ and ‘Telecommunication’.

The Labor Input Method (LI Method) used in the earlier series for compiling GVAPW from the ES assumed equal contribution from all categories of workers engaged in an economic activity i.e. the productivity of an employer, a casual wage worker, or a family worker is equal. The ELI method, on the other hand addresses differential labor productivity issue by assigning weights to the different categories of workers engaged in an economic activity based on their productivity. The weights have been estimated fitting a nested Cobb-Douglas production function using the data on establishments covered in the NSS 67th round Survey on Unincorporated Enterprises, 2010-11.

Nested Cobb-Douglas production function of the following form has been used.

$$Y = AK^\beta [L_2 + \delta_1 L_1 + \delta_2 L_3]^\alpha$$

Taking natural logarithm of both side and adding a dummy variable representing the sector (rural, urban), we get

$$\log Y = \log A + \beta \log K + \alpha \log [L_2 + \delta_1 L_1 + \delta_2 L_3] + \gamma S$$

where, $Y = GVA$,

$K = \text{Capital input}$

$L_1 = \text{Labor input of owner (in person days per year)}$

$L_2 = \text{Labor input of hired worker (formal + informal) in person days per year}$

$L_3 = \text{Labor input of helper (in person days per year)}$

$\delta_1 = \text{Marginal productivity of the owner relative to hired worker.}$

$\delta_2 = \text{Marginal productivity of the helper relative to hired worker, and}$

$S = \text{A dummy variable for sector (Rural} = 0, \text{Urban} = 1)$

$\gamma = \text{Coefficient of the dummy variable}$

The parameters of the above model are obtained from linear regression procedure. The coefficients of labor terms, δ_1 and δ_2 , in this equation give the relative marginal productivities which are used as conversion factors for conversion of “owners” and “helpers” equivalent of hired worker for computation of “effective labor input”. For example, $\delta_1 = 0.5$ implies that 10 owners are equivalent to 5 hired workers. Once the coefficients are estimated, the effective workers i.e. $[L_2 + \delta_1 L_1 + \delta_2 L_3]$ are estimated and hence effective GVAPW or GVA per effective worker (GVAPEW) are estimated for each compilation category. The same coefficients are used to estimate labour input from 68th round and is termed as effective labor input (ELI). Finally, the GVA for a compilation category is obtained as the product of GVAPEW and ELI for that compilation category.

The Effective LI method based on establishment has been modified in a few categories of non-financial services, namely, education, health, water transport, storage, real estate, renting of machinery, computer and related services, legal and accounting services, by using effective LI of rural establishments and urban directory establishments, as the case may be. This method would be referred to as “modified effective LI method”.

$$GVA = \text{Effective LI (Rural)} \times \text{GVAPEW (Rural Establishments)} + \text{Effective LI (Urban)} \times \text{GVAPEW (Urban Directory Establishments)}$$

In some other categories, namely, Trade and Repair services, Hotels and Restaurants and Non-mechanized Road transport, Telecommunication, where it was felt that the productivity of different categories of labor may not have a significant impact on GVA, especially in the unorganized segment, the “LI method” was used as below:

$$GVA = \text{LI (Rural)} \times \text{GVAPW (Rural Establishments)} + \text{LI (Urban)} \times \text{GVAPW (Urban Directory Establishments)}$$

4.3 Saving and Capital Formation

NSS data, particularly from the AIDIS, supports estimates of household savings and Gross Fixed Capital Formation (GFCF):

- *Household savings:* AIDIS data on household financial assets (e.g., savings in banks, shares, debentures) and liabilities (e.g., loans, debts) were used to estimate gross financial savings of the household sector in the earlier series. In the current series of NAS major data source for estimation of financial savings of household is the RBI.
- *Gross capital formation (GCF):* AIDIS collects data on household capital expenditure (e.g., on residential buildings, farm business, non-farm business), which contributes to estimating GFCF in the household sector, particularly in rural (Agriculture) and unorganized sectors
- *Household asset distribution:* AIDIS provides data on the stock of physical assets (e.g., land, buildings, livestock, machinery) and financial assets, used to estimate Net Fixed Capital Stock.

For example, AIDIS data from the 70th Round (2013) informed savings (in the form of physical assets) estimate in the 2011-12 base year revision.

4.4 Supply-use and input-output tables

Supply-Use Tables (SUTs) and Input-Output Tables (IOTs) ensure consistency across NAS approaches (production, income, expenditure). NSS data contributes as follows:

- *Supply Table:* Enterprise Surveys inform supply-side estimates for informal sectors, balancing production with consumption.
- *Use Table:* CES data provides household consumption expenditure, a key demand component, disaggregated by product categories. Enterprise Surveys inform use-side estimates of input flows of various product-groups from informal sector components under the industry-groups, balancing uses with production
- *Inter-Sectoral Linkages:* SUTs and IOTs, built largely using ASI data, capture flows between agriculture, industry, and services, ensuring macroeconomic coherence. For example, CES data on food expenditure aligns with agricultural output

estimates from Enterprise Surveys, reducing discrepancies.

4.5 Regional Accounts

NSS data, disaggregated by State and rural-urban areas, facilitates State Domestic Product (SDP) and District Domestic Product (DDP) estimation:

- *State-Wise Allocation:* CES and EUS provide consumption and employment data by state, enabling accurate SDP estimates.
- *Rural-Urban Insights:* Surveys like the Operational Land Holdings Survey (48th Round, 1991-92) estimate kitchen garden output, contributing 0.22% to rural operated area.
- *Income Adjustments:* NSS data adjusts income estimates based on residence concepts, ensuring regional accuracy.

5. METHODOLOGICAL FRAMEWORK

Integrating NSS data into NAS involves a structured methodology:

1. *Data Collection and Validation:* NSS employs rigorous sampling, validated against Census and Economic Sample Surveys for consistency.
2. *Scaling and Adjustment:* Micro-level data is scaled using population weights.
3. *Integration with Other Sources:* NSS data is combined with ASI, corporate accounts, and administrative data to ensure comprehensive coverage.
4. *Base Year Revision:* Periodic NSS rounds (e.g., 68th Round, 2011-12) provide benchmark data for revising NAS base years, aligning with economic shifts.
5. *Cross-validation enhances reliability:* Kar *et al.* (2003) compared ES-derived GVAPW with per worker consumption expenditure (PWCE) adjusted for savings, from the 1993-94 CES, finding under estimation in rural manufacturing and services (e.g., non-mechanized transport, other services) but consistency in trade and hotels/restaurants, suggesting robust estimates for these sectors.

This framework ensures NSS data's reliability in NAS compilation.

6. CHALLENGES IN UTILIZING NSS DATA

Despite its strengths, NSS data faces challenges:

- *Periodicity and Timeliness*: Quinquennial CES and irregular EUS result in out dated data, though PLFS mitigates this for employment (MOSPI, 2007).
- *Coverage Gaps*: ES under-cover sectors like transport (1993-94); ES estimated one-third of EUS workforce) and real estate (*cf.*, Kulshreshtha *et al.*, 2002).
- *Data Discrepancies*: Differences between ES and EUS estimates (*e.g.*, 1993-94 trade workforce: EUS 27.1 million vs. ES 23.3 million) and with ASI data complicate integration (*cf.*, Kulshreshtha *et al.*, 2002). Trade surveys omitted stock changes, leading to negative GVAPW (*e.g.*, Himachal Pradesh 1985-86: rural NDTE (-) Rs. 43, 773) (*cf.*, Kulshreshtha and Singh, 1995).
- *Sampling Errors*: Small sample sizes introduce errors, particularly for OAEs, where GVAPW is underestimated compared to consumption expenditure (*cf.*, Kulshreshtha *et al.*, 2002).
- *Capital Formation Estimates*: Negative or small estimates from ES (*e.g.*, hotels in 1983-84, trade DTEs in 1979-80) are often unusable (*cf.*, Kulshreshtha and Singh, 1995; Kulshreshtha *et al.*, 2002).
- *Validation Issues*: ES-derived GVAPW underestimation in rural manufacturing and services (*e.g.*, non-mechanized transport) requires cross-validation with CES PWCE (*cf.*, Kar *et al.*, 2003).

These challenges can affect NAS accuracy, particularly for dynamic economic indicators.

Table 1. Cross-validation of GVAPW from ES with PWCE from CES (1993-94)

Sector	Area	GVAPW vs. PWCE	Observation
(1)	(2)	(3)	(4)
Manufacturing	Rural	GVAPW < PWCE	Underestimation in ES
Trade	Urban	GVAPW ≥ PWCE	Reliable for NAS
Hotels & Restaurants	Urban	GVAPW ≥ PWCE	Reliable for NAS
Transport (non-mech.)	Rural	GVAPW < PWCE	Significant underestimation
Other Services	Urban	GVAPW < PWCE	Needs refinement

Source: Adapted from Kar A., Gulab Singh and A C Kulshreshtha (2003)

7. STRATEGIES FOR ENHANCING NSS DATA UTILIZATION

To address these challenges:

- *Increased Survey Frequency*: Conduct CES biennially and expand PLFS coverage (*cf.*, MOSPI, 2007).
- *Data Harmonization*: Standardize definitions across NSS, ASI, and other sources (*cf.* MOSPI, 2007).
- *Improved Sampling Frames*: Leverage updated Economic Census data to address under-coverage (*cf.* Kulshreshtha *et al.*, 2002).
- *Cross-Validation*: Regularly compare ES GVAPW with CES PWCE to correct biases, as demonstrated by Kar *et al.* (2003).
- *Trade-Specific Improvements*: Collect data on stocks, profit margins, and family consumption in trade surveys (*cf.*, Kulshreshtha and Singh, 1995).
- *Enhanced Capital Formation Data*: Improve ES fixed asset data collection (*cf.*, Kulshreshtha *et al.*, 2002). Employ econometric models and machine learning for extrapolation.

These enhancements align NSS data with SNA requirements, ensuring robust NAS estimates.

Table 2. Strategies for enhancing NSS data utilization in NAS

Strategy	Description
(1)	(2)
Increased Frequency	Conduct CES biennially, expand PLFS indicators
Data Harmonization	Standardize definitions across NSS, ASI, others
Improved Sampling	Use updated Economic Census for better coverage
Cross-Validation	Compare ES GVAPW with CES PWCE (Kar <i>et al.</i> , 2003)
Trade Survey Improvements	Collect stock, margin, consumption data (Kulshreshtha and Singh, 1995)
Capital Formation	Enhance fixed asset data collection (Kulshreshtha <i>et al.</i> , 2002)
Technological Integration	Leverage GST, e-commerce data
Statistical Techniques	Use econometric models, machine learning

8. CASE STUDY: BASE YEAR REVISION (2011-12)

The 2011-12 base year revision exemplifies NSS's role. The 68th Round CES (2011-12) provided updated consumption expenditure data, revealing shifts toward non-food spending. ES refined GVA estimates for unorganized sectors, building on historical benchmarks (*cf.*, Kulshreshtha *et al.*, 2002). EUS data improved workforce allocations. Some uses of NSS results in the 2011-12 base revision has been summarized in table 3 below for illustration:

Source: Adapted from Ministry of Statistics and Programme Implementation (2015): *Changes in the Methodology and Data Sources in the New Series of National Accounts – Base Year 2011-12*.

(a) Refers to the Section numbers of the source document *Ministry of Statistics and Programme Implementation (2015)*.

9. RECENT DEVELOPMENTS AND FUTURE DIRECTIONS

Recent developments include:

- *PLFS Introduction:* Annual employment data since 2017 (Ministry of Statistics and Programme Implementation, 2023b).
- *Base Year Update:* Currently planned 2022-23 base revision to incorporate results of Annual Survey of Unincorporated Sector Enterprises (ASUSE) and PLFS (Vision IAS, 2025).
- *Technological Advances:* Exploration of GST and e-commerce data.
- *Implementing International Recommendations:* Efforts to align with 2025 *System of National Accounts* standards. Future directions include increasing regional granularity and incorporating sustainability metrics.

10. CONCLUDING REMARKS

NSS data is indispensable for compiling accurate NAS, particularly for the informal sector. Surveys like CES, EUS/PLFS, and ES provide critical data for PFCE and GVA estimation, savings (in the form of physical assets) and capital formation of households as shown in the 2011-12 revision. Challenges like periodicity, coverage gaps, and GVAPW underestimation require strategies such as cross-validation, increased survey frequency, and technological integration. The current exercises on 2022-23 base year update underscores NSS's ongoing importance. By addressing these challenges, India can strengthen its statistical system, supporting robust economic policymaking.

The NSS data stands as an indispensable pillar in the compilation of India's National Accounts Statistics, bridging critical data gaps in an economy where the informal sector accounts for a substantial share of economic activity and employment. Through surveys such as the Household Consumption Expenditure Survey, PLFS, ESs, and AIDIS, NSS provides granular, representative data essential for estimating key aggregates like GVA, PFCE, GCF, and household Saving. Methodological advancements, including the labour input method, effective labour input approach, and nested Cobb-Douglas production functions, have enabled more nuanced assessments of productivity differentials and informal sector contributions, as evidenced in the 2011-12 base year revision.

However, persistent challenges—such as survey periodicity, coverage limitations, data discrepancies between sources like ES and PLFS, and underestimations in value added per worker—underscore the need for ongoing refinements. The strategies outlined herein, including biennial survey cycles, harmonization with administrative datasets (e.g., GST and MCA), enhanced sampling frames via updated Economic Censuses,

Table 3. NSS data used in the current NAS 2011-12 series

No.	NSS Survey Type	Round	Year	Sections Reference ^(a)	Usage in Methodology	Details/context
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Quinquennial EUS Employment and Unemployment	-	Every 5 years	2.3	Workforce estimates since 1993-94	Used for deriving workforce participation rates and employment structure in various sectors for national accounts. Data on employment in organized and unorganized sectors are referenced.
2	Employment and Unemployment (EUS)	61 st	2004-05	2.4	Used for previous series (base 2004-05)	

No.	NSS Survey Type	Round	Year	Sections Reference ^(a)	Usage in Methodology	Details/context
(1)	(2)	(3)	(4)	(5)	(6)	(7)
3	Employment and Unemployment Survey (EUS)	-	2009-10	2.4	Not used for new series as 2009-10 was not considered as a “normal” year.	The survey year succeeded the global slowdown of the year 2008
4	Employment and Unemployment Survey (EUS)	68 th	2011-12	2.4, 2.8, 2.21	Used for new series (base 2011-12), workforce estimates, effective LI method	Workforce participation rates used with estimated population from Population Census 2011.
5	Employment and Unemployment Survey (EUS)	68 th	2011-12	4.50	Estimates for unorganized Water Supply and unorganized portion of recycling	Using the wages and the number of workers duly adjusted for the population as per Census 2011.
6	Consumer Expenditure Survey(CES)	68 th	2011-12	2.8, 3.41	Estimating household savings	Household expenditures on gold and silver ornaments are treated as savings of households in the form of valuables.
7	Consumer Expenditure Survey(CES)	68 th	2011-12	4.7, 4.25	Output for toddy (a beverage) estimation and firewood	Using estimates of per capita consumption of toddy and firewood and estimated population
8	Consumer Expenditure Survey(CES)	68 th	2011-12	4.150	Ownership of urban dwellings output	Data on rental per dwelling for urban areas used with number of dwellings from Population Census 2011.
9	Consumer Expenditure Survey(CES)	68 th	2011-12	4.135, 4.137 4.139 4.143	PFCE for the group ‘Other cereals products and pulses products’, salt and spices, paan, Hotel and restaurants,	Using per capita estimates of these items from CES and the population estimates derived from Population Census
10	Consumer Expenditure Survey(CES)	68 th	2011-12		household consumption of electricity, health services, education	Using per capita estimates of these items from CES and the population estimates
11	Enterprises Survey (ES)	63 rd	2006-07	Table at page 165	Land and water transport by Cooperatives	As part of private corporate
12	Enterprises Survey (ES)	67 th	2010-11	2.8, 2.17	Data on employment, GVA per effective worker, weights for effective LI method	The weights for effective LI method have been estimated fitting a nested Cobb-Douglas production function using the data of 67 th round NSS
13	Enterprises Survey (ES)	67 th	2010-11	2.36	Output estimate of glass & glass products in the unorganised sector	Used with Annual Survey of Industries, 2011-12.
14	Enterprises Survey (ES)	67 th	2010-11	4.61	Estimating the production of bricks & tiles in un-organised sector,	Used with Annual Survey of Industries, 2011-12.
15	Enterprises Survey (ES)	67 th	2010-11	4.164	GFCF in the form of Intellectual Property Product by households	
16	AIDIS Debt and Investment	70 th	2013	3.23	Estimating GVA of private moneylenders,	Used with RBI’s “Report of the Technical Group to review legislations on moneylenders”, 2007
17	AIDIS Debt and Investment	70 th	2013	4.55	benchmark estimates for buildings construction	
18	Survey on Housing Conditions	65 th	2008-09	4.55(vi)	Household GFCF by type of assets Dwellings, Other Buildings & Structures	Estimated using capital expenditure on New Construction per dwelling from AIDIS 2013, number of dwellings and ratios for kutchha and pucca dwellings from NSS 65th round.
19	NSS Surveys (General)				Supplementary data for national accounts	NSS data are used alongside other sources (e.g., Population Census, ASI) to validate and supplement estimates for GVA, consumption, and savings
20	Situation Assessment Survey	70 th	2013	2.8	Used with AIDIS for GVA estimation	

rigorous cross-validation techniques, and integration of digital tools and machine learning, offer actionable pathways to bolster data quality and timeliness. These improvements are particularly pertinent as India prepares for the forthcoming base year revision from 2011-12 to 2022-23, slated for release in February 2026, which will incorporate recent surveys like ASUSE and HCES 2022-23 to capture post-COVID structural shifts, digital economy growth, and policy impacts such as GST formalization.

By addressing these imperatives, India can enhance the robustness, granularity, and international comparability of its NAS, aligning more closely with the 2025 SNA standards and supporting evidence-based policymaking in areas like fiscal planning, poverty alleviation, and sustainable development. Moreover, the insights from India's experience—drawing on decades of NSS evolution and integration with NAS—hold valuable lessons for other emerging economies grappling with informal sector dominance and data scarcity. Future research should explore the potential of big data analytics, real-time indicators, and hybrid survey-administrative models to further elevate statistical systems, ensuring they remain adaptive to rapid economic transformations. Ultimately, a strengthened NSS-NAS nexus not only fosters domestic economic resilience but also contributes to global efforts in achieving accurate, inclusive macroeconomic measurement.

Conflict of interest

The authors do not have any financial or non-financial conflict of interest to declare for the research work included in this article.

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