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**Title :** *Estimation of Capital Stock and Consumption of Fixed  
Capital in the Indian National Accounts*

**Author(s) :** **A.C. Kulshreshtha and V.K. Malhotra** -Central  
Statistical Organisation, India



# **ESTIMATION OF CAPITAL STOCK AND CONSUMPTION OF FIXED CAPITAL IN THE INDIAN NATIONAL ACCOUNTS \***

**A.C.Kulshreshtha and V.K.Malhotra  
Central Statistical Organisation, India**

## **1. INTRODUCTION**

1.1 The changing relationship between output and capital stock is an important aspect of the study of changes in productive efficiency in the various industries of a developing economy. Firm estimates of capital stock enhance the ability to associate capital formation with economic growth and to project future production possibilities, thereby leading to formulation of policies designed to achieve the desired economic objectives. These also provide a firm basis for estimating capital consumption needed to arrive at the estimates of various macro-economic aggregates on net basis. Official estimates of Net Capital Stock, Net Fixed Capital stock and Consumption of Fixed Capital of the Indian economy are compiled by the Central Statistical Organization (CSO), Government of India and disseminated through the annual publication: "National Accounts Statistics". Details of methodology and sources of data used in preparation of these estimates have been documented in the publication: National Accounts Statistics: Sources and Methods, 1989, CSO. In this paper present methodology in vogue and data sources have been spelt out indicating data gaps. Scope of improvement of the estimates has also been indicated.

## **2. CONCEPTS OF CAPITAL STOCK AND CONSUMPTION OF FIXED CAPITAL**

2.1 The reproducible fixed tangible assets are fixed assets used for the production of goods & services and are commonly known as fixed capital stock. These comprise of assets in the form of residential buildings, non-residential buildings, dams, irrigation & flood control projects, other construction works, transport equipment, machinery and equipment, breeding stock, draught animals, dairy cattle and the like, and capital expenditure on land improvement, plantations, orchard developments and afforestation. The fixed assets include uncompleted construction assets also. The stocks include the inventories of goods producing industries, trade, other industries and government. These comprise stocks of finished and semi-finished goods and young livestock except breeding stock, dairy cattle and the like, which form part of the fixed assets. It may, however, be clarified that the durable goods in the hands of households which are not used for further production of goods and services such as automobiles, refrigerators, washing machines, furniture, sewing machines, etc., as well as fixed assets mainly meant for defence purposes such as warships, fighter aircrafts, transport vehicles and war materials do not form part of the fixed capital stock as these are assumed to have been consumed as soon as they are purchased. However, the construction works undertaken by the households including buildings and capital expenditure on residential dwellings for defence personnel, border roads, ordnance factories etc., form part of the fixed capital stock.

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\* Views expressed are of the authors and not necessarily of the institution to which they belong.

2.2 Consumption of Fixed Capital (CFC) as per System of National Accounts (SNA) is defined as that part of gross product which is required to replace fixed capital used up in the process of production during the period of account. This flow is based on the concept of economic lifetime of the individual assets. As such the estimates of CFC at replacement cost are necessary so as to derive the estimates of net product, net capital formation as well as net saving on a realistic basis.

2.3 Capital is an important input in the production process. The quantity and quality of capital influence not only the productivity of capital but also that of labour and total output. The guidelines issued by United Nations Statistical Office (UNSO) on the National and Sectoral Balance-sheet and Reconciliation Account of the System of National Accounts (UNSO, 1977) and on Tangible Assets (UNSO, 1979) prescribe the estimation of CFC at current replacement cost for use in national accounts estimates on the basis of the estimates of Gross Fixed Capital Stock (GFCS) at current market cost for each type of assets used in production process and their expected average life using the Perpetual Inventory Method (PIM). The PIM also provides the estimates of Net Fixed Capital Stock (NFCS) at current market prices. Several developed countries like Australia, Japan, United States of America and United Kingdom are already preparing the estimates of fixed capital stock and the CFC based thereon and is using the same in their national accounts aggregates.

2.4 According to the guidelines issued by the UNSO on Tangible Assets referred to above, the value of the stock of inventories can be estimated more easily by using book value data gathered from balance sheets of enterprises or records of establishments. This is because of the nature of inventories, which are generally turned over frequently. Most of the stock at the end of the year will, therefore, have been purchased fairly recently barring in exceptional cases where the turnover frequencies happen to be low. As a result book values in such cases normally reflect relatively up-to-date prices. Therefore, the book value of stocks, according to the guidelines, can be used for the statistics of tangible assets without any adjustments. In Indian national accounts, adjustment of prices in case of inventories is done every year to take into account the fact that change in stock is evaluated at average price of the year under consideration - as recommended by System of National Accounts - 1993.

#### **4. PERPETUAL INVENTORY METHOD FOR ESTIMATING CAPITAL STOCK AND CONSUMPTION OF FIXED CAPITAL**

3.1 The common method of making the estimates of written-down replacement cost for fixed capital stock is the PIM. Figures of the written-down replacement value of the stock of fixed assets on a given date, say the beginning of a year, are based first of all on figures of Gross Fixed Capital Formation (GFCF), classified as much as possible according to type of fixed asset and year of acquisition, accumulated over a period to cover the acquisition of all fixed assets. The period should be long enough so that the fixed assets acquired before that period would have been retired, that is, their average useful life will have run out. Conceptually, the cost of acquisition of each class (same type and same year of acquisition) of fixed assets is adjusted to current gross replacement cost by an index of the average change in prices from the year of acquisition to the date in question; and allowance, valued at current replacement cost, for accumulated depreciation between the two dates is deducted in order to arrive at its written-down current replacement cost. In practice, the perpetual inventory may be built year-by-year at the constant prices of a given year. Net capital formation (GCF less the allowance for depreciation) during a year, adjusted to constant prices, for a class of fixed assets is added to the written-down value of its accumulated net capital formation at the beginning of the given year at constant prices. The resulting constant price value of the net capital stock as of the beginning of the next year is converted to current replacement cost as of the later date. Various approaches to writing off the value of fixed assets, such as straight-line depreciation; declining balance and declining rate of depreciation are available in literature, but in PIM, the straight-line approach is recommended as it is commonly used in the business accounting. Once the perpetual inventory is built, it is to be maintained year-by-year by the same means as are outlined above. Alternatively, the PIM may be used on the basis of year-by-year extension of data gathered in national censuses or from fire insurance records on the written-down value of the stock of fixed assets as of a given date, classified to the extent possible according to type and age. The PIM can, of course, also be used to estimate the gross replacement value of fixed assets. Accumulated depreciation in that case need not be deducted for arriving at the initial estimates of the gross replacement cost of the capital stock, and the value at constant prices of GFCF rather than NCF is added year-by-year.

3.2 The gathering and compilation of appropriate price index numbers on capital goods for purposes of the PIM raise difficult conceptual and practical problems. Since each construction project and each piece of highly fabricated heavy machinery and equipment is produced on contract and usually consists of unique features, the compilation of comparable series of price indices need to be based on the prices which are representative model of proxies. Price series on the models may be based on direct estimates of producers, on the combination of comparable prices of components or on regressions of the transaction values (costs) of completed projects on their strategic characteristics. Even in the pricing of less complex capital goods, as proxies or in their own right, serious problems of inadequacies in accounting for quality changes are encountered. The replacement cost arrived at from these price series can be taken as only approximations to market values. In addition to the complications and deficiencies mentioned above, many of the price series gathered on capital goods give too little attention to the valuations of

purchasers and, therefore, do not reflect the forces of demand which, together with those of supply, determine the market prices.

3.3 The various steps followed in PIM adopted in the national accounts are as follows:

- i) Assumptions are made about the average length of life of each class of assets separately distinguished;
- ii) GFCF is estimated for each class of assets for 'L' years prior to 'Y', where 'L' is the average life of an asset and 'Y' is the year for which capital consumption and gross stock are to be estimated;
- iii) Appropriate price indices are identified and applied to the estimates of GFCF at current prices to convert them to constant prices;
- iv) The estimates of GFCF at constant prices are aggregated for 'L' years to obtain the estimates of GFCS at constant prices at the end of the year;
- v) The GFCS of an asset is divided by 'L' to obtain the estimate of capital consumption at constant prices;
- vi) The price indices are used to convert the estimates of capital consumption to current prices or to another price base;
- vii) The estimates of NFCS (i.e. GFCS for the year 'Y' minus accrued capital consumption during 'L' years) for the year 'Y' are first calculated at constant prices and then converted to current prices using appropriate price indicators; and
- viii) Having arrived at the capital stock at the end of the year 'Y', it is maintained year-by-year by the same procedure as outlined above.

3.4 The above steps involve collection, compilation and categorization of considerable amount of data on various types of assets and their prices for estimation of fixed capital formation and CFC separately for each class of assets and working out the same at constant prices under assumptions about their average life.

#### **4. ASSUMED LIFE OF ASSETS**

4.1 PIM necessitates the availability of reliable estimates of average age of various types of fixed assets in different industries. However, no life table of fixed assets is currently available in India. Detailed discussions were held by CSO with the concerned agencies like Directorate General of Technical Development; Ministry of Industry; Railway Board; Bureau of Industrial Costs & Prices; National Productivity Council; Delhi Electric Supply Undertaking; Departments of Posts & Tele-communications; Central Road Research Institute; Central Water Commission; Ministry of Shipping & Transport and Indian Roads Congress and the requisite information on average age of various assets obtained. Data on average life of machine tools in the reports of Censuses of Machine Tools (1968 & 1986) conducted by Central Machine Tools Institute, Bangalore, were also examined. The average life of assets on the basis of depreciation provision under Income-Tax Rules as well as in the Companies (Amendment) Act, 1988 have also been considered. On the basis of the above materials as well as discussions held with concerned experts, the average life for different type of assets had been assumed. In the case of roads and canals, it has been assumed that the current expenditure on repairs and maintenance are sufficient to maintain these assets for a long time. As such no depreciation need be provided for such assets.

#### **5. PROCEDURE OF ESTIMATION**

5.1 The estimates of net capital stock separately for NFCS and stock of inventories as on 31 March, 1981 and the CFC during the year 1980-81 have been prepared by type of institution and by industry of use for each type of asset. For estimation of CFC, the straight-line method has been utilized. The PIM does not provide for adjustment of capital losses in the estimates of capital formation. The capital losses need to be adjusted in the Reconciliation Account. In principle, there does not seem to be any justification not to adjust the capital losses that have taken place during a year in the estimates of capital stock. However, it has not been possible to make these adjustments in the Indian national accounts, as the necessary data on capital losses are not available.

5.2 For the purposes of estimation of GCF, NFCS and CFC, the economy is divided into three broad institutional sectors i.e., public sector; private corporate sector; and household sector (residual), as also into various industry groups i.e. agriculture; forestry & logging; fishing; mining & quarrying; manufacturing; construction; electricity, gas and water supply; transport, storage & communication; trade, hotels & restaurants; banking & insurance; real estate, ownership of dwellings & business services; public administration & defence; and other services. The annual estimates of GCF at constant (1980-81) prices are prepared as per laid methodology in National Accounts Statistics: Sources and Methods, 1989. Since these estimates are not prepared for each type of assets as required by PIM, the estimates have been made, specifically for the purpose at current prices. These have been converted to constant (1980-81) prices using appropriate price indices. The procedure of estimation of NFCS, CFC and stock of inventories for each of the institutional sectors/sub-sectors and for industries within these institutional sectors is described in the following paragraphs.

## 6. DATA SOURCES AND METHODOLOGY ADOPTED FOR ESTIMATING NET FIXED CAPITAL STOCK IN THE INDIAN NATIONAL ACCOUNTS

### Public Sector

6.1 Public sector comprises administrative departments, departmental commercial undertakings (DCUs) and non-departmental commercial undertakings (NDCUs). For each of the sub-sector industry-wise estimates of NFCS and CFC are prepared separately.

6.2 Data on capital outlays in administrative departments up to the year ended 1949-50 at book value have been collected from the Report of Combined Finance & Revenue Accounts (CFRA) of the Central and State governments, 1949-50. The book value of these assets up to the year ended 1949-50 has been converted at replacement cost using the revaluation ratio of 2.8 worked out from the data on book value and replacement cost in respect of railways and irrigation assets. Annual data on GFCF by type of assets and industry of use are available from the already compiled National Accounts Statistics (NAS). These estimates have been further disaggregated into those relating to buildings, roads & bridges, other construction works, transport equipments, machinery & equipments and net purchase of second hand physical assets (NPSA). From the year 1980-81 onwards NPSA has been appropriately assigned in NAS to the respective categories on the basis of details available in budget documents and reports of the undertakings. For the years prior to 1980-81, NPSA has been distributed into above categories except roads & bridges and other construction works on pro-rata basis. The capital outlays up to the year 1949-50 at replacement cost and the estimates of GFCF at industry level at current prices have been converted into constant (1980-81) prices for all industries and for all types of assets by applying the under mentioned relevant price indices given in the following statement.

Type of asset	Index used
Buildings	Index number of cost of construction of urban buildings
Other construction	Index number of cost of construction of other construction works (accounted)
Roads & bridges	Index number of cost of construction of roads & bridges
Transport equipment	Wholesale price index for transport equipment
Machinery & equipment	Wholesale price index for machinery & machine tools

6.3 The estimates of NFCS and CFC for the year 1980-81 have been compiled separately for the assets created before and after 1949-50. These have been aggregated to arrive at the total NFCS and CFC for the year 1980-81. The assets prior to 1949-50 accumulated over the past years have been assumed to have outlived half of their life. As such for applying PIM half of the assumed life has been taken for such assets and annual CFC has been kept constant till these assets have retired i.e., without decreasing GFCS until it depreciates in full. It may be mentioned here that

only construction assets have been taken into account as the assets in respect of plant and machinery created prior to 1949-50 would have retired by 1980-81.

6.4 For the assets created from 1950-51 onwards the estimates of GFCF at constant (1980-81) prices have been accumulated to estimate GFCS at the end of each year. The NFCS and CFC have been estimated by PIM taking average ages.

6.5 For railways and irrigation projects data on capital outlays were compiled from the year 1853 and 1876 onwards from the Ministry of Railways and Report of the CFRA respectively. For other industries book value of assets for the year ended 1949-50 have been compiled from the report of the CFRA for want of details for earlier years. An examination of the balance sheet of the Railways followed by discussion with the Railway authorities revealed that the total capital outlays up to the end of a particular year were net of capital expenditure on renewals and replacement by like items as these are not treated as new capital outlays by the Railways. However, these outlays include capital outlays of land and stocks (inventories) as well. Besides, the series of estimates of capital outlays for the Railways and also for irrigation are not comparable over all the years, due to the fact that in 1937 Burma being separated from India and again in 1947 due to creation of Pakistan was separated and thus assets were transferred to these countries. These assets have been suitably readjusted for the previous years by applying a proportion of the assets, which remained in India to the total assets as existing before 1937-38 and 1947-48 respectively. From this derived series of total capital outlays at historical prices which is net of expenditure on renewal and replacements, the series of net capital formation at book value has been obtained on the assumption that expenditure on renewals and replacements compensates is for the allowance for depreciation. The same has been converted into 1949-50 prices with the help of general index of wholesale prices for all commodities available since 1861 from Director General of Commercial Intelligence and Statistics (DGCIS) and Office of the Economic Advisor with different base years by suitably linking the series. It may be pointed out that the commodity-wise indices for machinery and inputs of items of construction, i.e. steel, cement, etc., prior to 1949-50 are not available. Moreover, since most of the assets prior to 1950 would have retired by 1981, the use of general index does not vitiate the estimates of fixed capital stock and CFC after 1981. Incidentally, it may be added that in spite of best efforts it has not been possible to obtain corresponding representative indices from the Central Statistical Office of the United Kingdom for the pre independence period. The estimates of net capital formation at 1949-50 prices so arrived at have been accumulated over the years to obtain the total net capital stock at the end of the year 1949-50 at current prices. The net capital stock at the end of 1949-50 so arrived at is inclusive of land value and inventories as mentioned above. In order to derive the NFCS, the value of land and inventories has been excluded with the help of detailed break up available in Railway budget explanatory memorandum since late fifties. This estimate of total NFCS is disaggregated into buildings, roads and bridges, track, rolling stock and plant & machinery in the ratio of the break up of the total fixed capital of Railways in the late fifties to arrive at the total fixed capital at the end of 1949-50 for each type of assets in the Railway. It has been assumed that the assets existing at the end of the year 1949-50 have completed half of their average life.

6.6 The estimates of capital outlays prior to 1949-50 are available for all DCUs and separately only for railways and irrigation (which accounted for major portion of the total fixed assets in departmental enterprises in 1950). For the DCUs other than railways & irrigation, industry-wise capital outlays are not available and as such the procedure followed above could not be used to revalue the assets of these DCUs. The book values of assets prior to 1949-50 for these enterprises have been converted to replacement cost using the combined replacement ratio of 2.8 obtained for railways and irrigation.

6.7 These assets at the end of 1949-50 (at current prices) have been converted to 1980-81 prices with the help of relevant price indices. The data on GFCF have been compiled from the budget documents and results on public sector transactions available in the NAS. The estimates of GFCF at 1980-81 prices have been prepared using the price indices as for the administrative departments except for the railways permanent ways and rolling stock. For these, the 'Index of cost of construction of railway permanent way' and 'Wholesale price index for rolling stock' has respectively been used.

6.8 The PIM was applied as in the case of administrative departments separately for the stock of assets existing at the end of 1949-50 and created after 1949-50 for each type of assets under each industry.

6.9 The data on stock of fixed assets at the end of the year 1949-50 for NDCUs in the case of mining and transport undertakings have been collected from the report of Taxation Enquiry Commission (Ministry of Finance, 1958). The book value of these assets is only about Rs. 1 crore. As these assets may be of recent origin, revaluation has not been done. For manufacturing, electricity and other industries, assets have been assumed to be negligible as most of the undertakings were established after 1950-51. At the aggregate level, in case of manufacturing industry, the data on GFCF for the period 1948-49 to 1959-60 has been taken from the research studies by Jagdish Kumar et al (1963), 'Transactions of Public Sector' (CSO, 1983) and the various issues of NAS. The estimates of GFCF at current prices have been compiled by industries with break up into buildings, other construction works, capital work in progress (CWP), expenditure during construction (EDC), transport equipment, plant & machinery and NPSA. For adjustment of CWP and EDC, the reports of the NDCUs have been analyzed in detail with a view to know the type of these entities. The estimates of GFCF at current prices have been converted into constant (1980-81) prices with the help of relevant price indices as in the case of administrative departments. The estimates of NFCS and CFC have been prepared by PIM using the pre decided age of assets.

### **Private corporate sector**

6.10 This sector comprises public limited companies and private limited companies i.e., companies in the private sector set up under the Companies Act and credit and non-credit co-operative societies. The Reserve Bank of India (RBI) have published the industry-wise all-India data on fixed capital stock based on sample studies for the non-government, non-financial public limited companies for the year ended 1949-50. In regard to private limited companies, data on fixed assets based on RBI sample studies are available for 1949-50 in the report of Taxation

Enquiry Commission, 1958. These estimates have been blown up with the help of data on Paid up Capital (PUC) for sample companies to all companies at the industry level. The estimates for the banks and other financial institutions have been based on the research studies made by Mukherjee & Sastry (1959). The estimates of GFCF in private corporate sector for 1950-51 onwards at the aggregate level are available in various issues of NAS separately for joint stock companies and co-operative societies and these estimates have been built up at the industry level. The estimates of fixed assets at the end of 1949-50 for co-operative societies are not available. These are, however, expected to be negligible as the co-operative institutions are of recent origin.

6.11 As the stock of fixed assets as on 31 March 1950 is available at book value, it is to be revalued at 1949-50 prices and subsequently converted to 1980-81 prices. The revaluation ratio as used in public sector could not be used in private corporate sector, because the proportion of the construction assets is much larger in case of railways and irrigation compared to private corporate units. Also the various industries in private corporate sector, set up at different point of time, may not be as old as establishment of railways and irrigation system in India. In view of this an exercise was attempted by carrying backward the estimates of fixed capital stock at book value for 1949-50 as far back as 1900-01 on the basis of index of industrial production as given in "The Note on the Long Term Growth of National Income in India, 1900-01 to 1952-53" (Mukherjee, K., 1960) and index number of wholesale prices. The series of fixed capital formation so derived at 1949-50 prices has been accumulated over the years to derive the estimates of fixed capital stock as on 31 March, 1950 at replacement cost. The ratio of this estimate at replacement value to that of book value works out to 2.4 which when compared with the ratio of 2.8 for railways and irrigation seems to be reasonable. As the replacement ratios are expected to vary over the industries, the overall ratio of 2.4 has been adjusted suitably at the industry level. This adjustment has been done on the basis of data on proportion of value of depreciated stock to total value of fixed assets as available in the RBI study on Finances of Joint Stock Companies (1948) and the proportion of construction assets to total assets in various industries.

6.12 The estimates of Capital Stock as on 31 March 1950 & GFCF from 1950-51 onwards at current prices have been converted to 1980-81 prices with the help of appropriate price indices. The PIM has been applied to estimate NFCS, CFC for all industries.

### **Household Sector**

6.13 The household sector comprises of household, unincorporated enterprises and non-profit institutions. The estimates of NFCS of household enterprises in respect of agriculture (excluding land improvement and livestock) and ownership of dwellings have been prepared as on 31 March, 1981 on the basis of data of net capital stock available from the results of All India Debt and Investment Survey (AIDIS), 1981-82 as contained in NSSO report No. 318 and some data specially got tabulated. It may, however, be mentioned that separate data on capital expenditure on land and plots are not available as the same are included in the expenditure on fixed assets. The expenditure on land & plots has been excluded using the ratio as obtained from the detailed analysis of capital expenditure available from AIDIS, 1971-72 as similar data from AIDIS, 1981-82, are not available. Moreover, AIDIS, 1981-82 does not give

separately values of improvement of land and irrigation works, but the same are merged with the value of land. Such expenditure during the year is, however, treated as part of capital formation. The estimates of NFCS of this category have, therefore, been prepared using estimates of gross capital expenditure at current prices on the basis of data available from All India Rural Credit Survey (AIRCS), 1951-52; All India Rural Debt and Investment Survey (AIRDIS), 1961-62; AIDIS, 1971-72 and 1981-82. The estimates of capital formation at current prices have been converted to constant prices using index of other construction works.

6.14 In the case of livestock, AIDIS provide data on capital stock inclusive of poultry and young livestock. However, poultry and young livestock form part of inventories. The estimates of net capital stock available from AIDIS have been divided into fixed assets and inventories on the basis of state-wise analysis of Indian Livestock Census (ILC) data and the average price per head of various types of livestock available from the state governments. Thus, the estimates as on 31 March, 1981 are based on AIDIS data for 1981-82.

6.15 The AIDIS, 1981-82 does not provide the estimates of gross capital stock. As such, it is not possible to attempt the estimates of CFC in respect of agriculture and ownership of dwellings on the basis of data available from AIDIS, 1981-82. The estimates of GFCF of these industries are, however, available in the NAS. In the case of agriculture, the stock of fixed assets at the end of 1949-50 has not been taken into account as the same would have retired by 1980-81. For ownership of dwellings, the estimates of NFCS for rural and urban residential buildings is taken from the research studies by Mukherjee & Sastry (1959). The estimates of CFC for these two categories have been prepared using PIM.

6.16 For the remaining industries in the household sector, AIDIS does not provide data at the industry level. Furthermore, AIDIS does not cover non-profit institutions. In order to prepare the estimates of NFCS for these industries, the estimates at the end of the year 1949-50 as available from the research studies by Mukherjee and Sastry (1959) have been taken as the base. For the subsequent years, data on GFCF at current prices as available from the NAS have been utilised. The estimates of GFCF at current prices have been converted to constant prices using the price indices in respect of construction and machinery as in the case of private corporate sector. The estimates of NFCS and CFC for the year 1980-81 have been prepared using the pre decided age of assets.

## **7. DATA SOURCES AND METHODOLOGY ADOPTED FOR STOCK OF INVENTORIES**

7.1 Estimates of the stock of inventories as on 31 March, 1981 have been prepared by type of institution, i.e., public sector, private corporate sector and household sector within each industry group using available source material. The method followed and data sources used are described below.

## *Public Sector*

7.2 The estimates of inventories within the public sector have been compiled separately for administrative departments, DCUs and NDCUs. In the case of administrative departments of the Government, the stocks held are in the nature of (i) policy stocks like food, fertilizers etc., and (ii) work stores under the civil works departments and consist of cement, bricks, steel, etc. The policy stocks are given in the form of purchases and sales during the year and the net purchases during the year as obtained from the economic & purpose classification of the budget documents and the same are classified as change in stock. However, the CFRA give net purchases as on 31 March of each year. Net purchases as on 31 March, 1981 have, therefore, been taken from the CFRA. In the case of work stores, the Government under the appropriate heads of account maintains suspense accounts. Addition to the stocks is shown against the suspense appearing in the expenditure side, while the withdrawals out of these stocks during the year are shown against the 'receipts and recoveries on capital account'. The purchases during the year minus withdrawals are treated as change in stocks. In the case of works stores, however, it has been noticed that the change in stocks during the year in most of the years is negative. The corresponding figures as on 31 March available from CFRA are also substantially negative year after year. Discussions were held with the officers of the Ministry of Finance, CPWD and others to find out the possible reasons for the negative stocks as on a particular date as well as during the year. Both the Ministry of Finance and CPWD clarified that the procurement of stock of inventories are shown in the suspense account under the expenditure account and withdrawals are shown under recoveries. As per feed back received it is felt that normally stock of stores and raw materials at least for one month at any point of time are scrupulously maintained. For instance, in the case of a thermal power station, the minimum stock of coal required for one month is generally maintained.

7.3 Considering, therefore, the abnormal results obtained in the case of change in stocks for work stores out of the economic and purpose classification of government budgets and also the discussions with the concerned authorities, it was not possible to arrive at the stocks as on a particular date on the basis of suspense account relating to work stores as contained in the budget documents. However, it is a common practice to maintain the stock of commodities to last for about a month. On this supposition the stock of work stores at the end of the year in the administrative departments is obtained by taking 1/10th of the capital formation during that year and balance the capital finance account of administrative departments by making suitable adjustments in the 'other liabilities'. Based on this proposition, the stocks have been reworked and used.

7.4 In the case of DCUs like railways, communication, etc., the stock of inventories as on 31 March, 1981 are available from their annual reports as well as from budget documents. In the case of NDCUs data on stock of inventories as on date are available from their balance sheets and for 31 March, 1981, these have been compiled for all the undertakings from their balance sheets, separately for each industry group.

### *Private corporate sector*

7.5 In the case of joint stock companies, the RBI's sample studies of public and private limited companies carried out annually provide the industry-wise estimates of total stock of inventories as on 31 March of each year and for 31 March, 1981, the same have been used. In the case of co-operative societies, data on stock of inventories are available from the National Bank for Agriculture and Rural Development (NABARD) publication 'Co-operative Movement in India'. For 31 March, 1981, the estimates of stock as obtained from this publication have been adopted.

### *Household sector*

7.6 **Agriculture:** The household inventories in agriculture pertain to livestock only. Inventories in case of cash crops, as mentioned in the Brochure on New Series of NAS brought out by CSO in February, 1988 have been assumed to be negligible. The inventories in case of livestock have been obtained after a detailed exercise using the estimates of number of cattle of different categories and the corresponding prices in different states. Inventories in respect of foodgrains with producers and consumers, if any, are covered under the trade sector.

7.7 **Manufacturing (Registered):** The Annual Survey of Industry (ASI) covers inventories of registered manufacturing factories which belong to public sector, private corporate sector and households. The book value of these inventories have been adjusted for the inventories of defence factories not covered in ASI on the basis of special returns received from the Ministry of Defence and the same have been adopted.

7.8 **Manufacturing (Unregistered):** The inventories in unregistered manufacturing are being estimated as 36 per cent of the GVA in connection with the annual estimates of NAS on the basis of the data available from (a) Report No. 280/6, Table with Notes on Survey of Self Employed Households in Non-Agricultural Enterprises-Detailed results for All India, 29th round (1974-75) (NSSO, 1978), (b) Survey of Small Scale Industries in the Unorganised Sector in Urban Areas, 1971-72, mimeograph (CSO, 1975) and (c) Special Tabulation of Census of Small Scale Industries undertaken by Development Commissioner, Small Scale Industries (DCSSI) in 1977.

7.9 **Transport by other means:** For want of any data, the ratio of GVA and inventories observed in road and water transport in the public sector has been applied to obtain the inventories of the household sector.

7.10 **Trade:** As mentioned above, the estimates of stock of foodgrains with the private traders, producers and consumers have been worked out on the basis of the method followed by Dandekar (1986) in his work on "Agriculture, Employment and Poverty" - a paper presented in the conference organised by the Centre for Asian Development Studies, Boston University, October, 1986. According to this method, consumption of foodgrains has been subtracted from the net availability with the public to arrive at the estimates of stocks. The

quantitative stock of cereals and pulses as on 31 March, 1981 has been evaluated with the help of corresponding prices. The inventories of commodities other than foodgrains in household trade have been worked out on the basis of bank advances to traders against the stock held by them. The banks normally keep a margin of about 45 per cent while making the advances. For example, against a stock of Rs. 1,00,000, the bank normally will advance Rs. 55,000. This bank margin has accordingly been taken into account while estimating the stocks with the traders.

## **8. DATA GAPS AND SCOPE OF IMPROVEMENT**

8.1 There are 15 critical problems in economic statistics recognized at the 18<sup>th</sup> session of the working group on International Statistical Programmes and Coordination (New York, 16-19 April 1996). One such problem is of "Measurement of Capital Stock". A conference was organized by the Expert Group at Canberra from 10 to 14 March 1997. This conference discussed the practices and problems of the participating countries in estimating the capital stock besides the conceptual aspects, alternative approaches to measuring capital stock, new measures of capital related to the extension of the asset boundary as recommended by System of National Accounts, 1993 (SNA, 1993) etc. Almost all the participating countries are adopting Perpetual Inventory Method. India is also following the same. It was noticed in the said conference that there are significant differences in the level of detail used in terms of sectoral, industry and asset types. There is also a significant degree of commonality in the problems reported by the participating countries concerning their current systems for deriving capital stock estimates. These include:

1. Lack of empirical data directly relevant to individual countries on asset service lives for different types of assets;
2. Inadequate dissection of estimates by type of equipment;
3. Privatization – difficulty of satisfactorily implementing intersectoral capital stock adjustments;
4. Difficulties in redistributing capital stock acquired through financial leases to industry of use;
5. Lack of data on second-hand transactions;
6. Inadequate treatment of extraordinary events and unforeseen obsolescence.

8.2 India too is facing the above mentioned problems/difficulties. The lack of current data regarding asset service lives is the most important. The methodology adopted, the estimates of capital stocks and that of CFC of various institutions and industry sectors can be improved to a very large extent if the requisite data is made available. No Wealth/Capital Stock Survey has been conducted in India so far. It is true that such a survey has to be specialized type of survey and would require enormous resources. In the absence of such a survey, it is indeed very difficult to have proper estimate of the stock. The estimates of Roads and Bridges; Buildings and Other Constructions may continue to pose the problem of estimation of old stocks due to their nature of being of long life. The estimates of average productive (Economic) age of Bridges, Buildings and other construction works are :

<b>Construction</b>	<b>Age in years</b>
Residential/non-residential pucca buildings	80
Residential kutcha buildings	20
Bridges	100
Irrigation works including dams, canals etc.	100
Improvement of land	30
Plantations	20
Railway track	55
Electricity transmission works	45
Other construction works	35

8.3 For the construction assets having average age of less than 50 years, the problem of estimating old stock now does not pose much of the problem as the same can be cross checked by cumulating the gross fixed capital formation at constant prices. In case of other assets, the present problem of correctly estimating the capital stock is taken care partly only as the complete run the assets' age is not yet over. The average age of various Plant & Machinery and Transport Equipments taken in the Indian national accounts are :

<b>Plant &amp; Machinery and Transport Equipment</b>	<b>Age in years</b>
Agriculture Machinery	9
Construction machinery	10
Mining machinery	10
Manufacturing machinery	20
Railway plant & machinery	20
Other plant & machinery	15
Furniture	20
Electricity generators	25
Tongas, rickshaws, carts etc.	8
Aeroplanes, buses, trucks, jeeps, cars etc.	10
Ships, vessels, motor boats, trawlers etc.	15
Railway coaches, wagons & engines	33

8.4 The above estimates do suggests that the estimates of gross capital stock of various industrial sectors of the three institutions can also be estimated by cumulating the gross fixed assets respectively for various industrial sectors of the institutions. In fact it has been verified that the estimates generated by the two methods were very close. But the fact remains that the estimated age of various assets is not necessarily close to reality. In fact the estimation of

age of the assets is a big issue because of deficiency of reliable data. The whole estimation of gross/net fixed capital stock revolves round this key variable. The estimation of this key variable was attempted in India by adopting the procedure as explained in paragraph 4.1 above. No right source of data has been available. Mostly, it is just the opinion or assumption of the various field experts, but is not based on the authentic direct data observed on the life of various assets being used by various industries of India. The estimates so prepared are again being compared to the latest opinions expressed by various experts/ organisations. It has been observed that the estimates generated earlier by CSO in respect of India are not at much variance still. The depreciation provisions made under Income - tax rules depict the estimates generated so are at some what low level than what were estimated by CSO in the year 1988-89.

8.5 India is a vast country comprising of thirty two states and union territories. There is a need to estimate the similar aggregates at the state level too. The states in India have the mandate of preparing such estimates. But the efforts in this direction are not to the desired extent. CSO has provided the State Directorates the methodology to be adopted in the preparation of state level estimates of gross capital formation, consumption of fixed capital and capital stock. But the success seen so far is only in respect of gcf and that too only in a few states only. Scope of improvement is therefore large.

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