Chapter- IV

COST ESTIMATES : THE METHODOLOGY
In this chapter we will briefly explain the procedure adopted for estimating cost of production of agricultural commodities. The cost estimation in agriculture, as is well known, involves certain complicated problems. Apart from designing a suitable sampling technique and collecting the input values from the selected sample holdings, it involves evaluation of farm assets, estimation of depreciation charges for fixed capital, allocation of joint costs to individual crops, imputation of owned inputs and services etc. The final derivation of the unit cost of an agricultural product in terms of area and output can be made only after working out these values, the methods to be followed for most of which may be arbitrary, in the absence of any universally acceptable formula. We will examine in what follows all these aspects of cost estimation separately. Our emphasis, while doing so, will be mainly on the Comprehensive Scheme (CS), though we will also indicate, wherever possible, the uniformities on differences of CS with the estimation procedure adopted in Farm Management Surveys (FMS). The reasons for our emphasis on CS are
that: Firstly, though, from the very beginning, APC was reluctant to use FMS cost, it has been regularly obtaining, despite with a small time lag, and applying CS costs for the fixation of procurement prices. Secondly, CS estimates are first shown to the concerned governments of the States from where they are collected, and discussed with them, before finalising the reports on cost of production and made available to APC for reference.¹ The estimates of costs available from CS should, therefore, be considered as acceptable not only to APC but also to the concerned State governments, which have to finally implement the price policy that is advised by APC.

CS originated from the recommendations of the Standing Technical Committee on Indices of Input Costs


which was appointed by the Government of India in 1967 with Dr. Ashok Mitra, the then Chairman of APC as its Chairman, for the purpose of providing "necessary guidance in organising the collection of data on indices of input costs and also in organising cost of production surveys on an integrated basis". The Committee examined the present position about the availability of the cost of production data in the light of the conceptual issues involved in the collection and analysis of these data, the deficiencies in the existing data, suggested the need for comprehensive data on cost of production, and provided necessary guidelines regarding the manner of collecting fresh data in future. In particular, the Committee recommended that a comprehensive scheme may be drawn for studying the cost of cultivation of principal crops in India; and the same may be launched from 1968-69 kharif season. According to it, the scheme was to be carried out under the technical guidance and supervision of a Central Committee of Direction, consisting of the representatives from Agricultural Prices Commission, Directorate of Economics and Statistics, Institute of
Agricultural Research Statistics, Agricultural Universities, Agro-Economic Research Centres, and a few outside experts. It also recommended that, in addition to the data on cost of production, "it would be useful if information on earnings through alternative modes of investments, typified say, by the typical rates of interest prevalent in the different regions is collected" since, for fixation of agricultural prices, it is necessary to have some idea about "what might be deemed to be a fair return on farm investments".

The scheme for the study of the cost of cultivation of principal crops in India was prepared by Institute of Agricultural Research Statistics. This scheme, as modified by the Standing Technical Committee and accepted by the Government of India, provides for the collection

of representative data on inputs and outputs of the
principal crops grown in India and estimation of unit costs
in terms of area and output according to various concepts
of costs, such as, Cost-$A_1$, Cost-$A_2$, Cost-$B$, and Cost-$C$,
as well as values of main-products and by-products of each
crop. Thus, initially, a detailed survey was carried out
in four States in 1970-71 and twelve other States in
1971-72, on the principal crops grown in these States
(in stead of in 1968-69, as recommended by the Committee).
This was followed by a sub-sample survey on about 25 per
cent of the main samples of each crop for a few years.
In 1974-75 and 1975-76, the survey on the main samples
was again repeated. While collecting the data from the
sample holdings of a given principal crop, the information
in respect of other crops grown on those samples were also
gathered. Thus, from each state, data on inputs and outputs
were collected under CS not only in respect of the
principal crops grown there, but also in respect of other
crops which accounted for at least 5 per cent of the
total operational area in the state.
1. The Sampling Design

CS envisages a three-stage stratified random sampling design with tehsil as the primary sampling unit, a cluster of three villages as the secondary unit, and an operational holding within a cluster as the third and ultimate stage sampling unit. The country as a whole is firstly broadly divided into three crop regions, namely, rice region, wheat region and millet region. These crop regions are not divided exclusively, in other words, these regions do cut across the boundaries among one another. For the purpose of administrative convenience, however, the crop regions are divided according to States. Thus the rice region, for the purpose of CS, comprises the states of Assam, Bihar, West Bengal, Orissa, Andhra Pradesh, Tamil Nadu and Kerala. Apart from rice, the important crops of this region on which cost data are collected at present are jute in West Bengal, Assam, Bihar and Orissa, sugar cane in Bihar, Andhra Pradesh and Tamil Nadu. The main wheat producing regions in the country are Uttar Pradesh, Haryana, Punjab and Madhya
Pradesh. The States of Himachal Pradesh and Jammu and Kashmir also are included in wheat region for the purpose of cost estimates. The other important crops of this region on which cost data are collected at present are sugarcane in Uttar Pradesh, Punjab and Haryana, cotton in Punjab and Madhya Pradesh, rice and oil seeds in Uttar Pradesh and Madhya Pradesh etc. Lastly, the States constituting the 'millet region' are Rajasthan, Gujarat, Maharashtra and Karnataka. Though jowar, bajra, maize and ragi are the main crops grown in this region, there are also other important crops, like, cotton, groundnut, sugarcane and rice are grown in this region, which are also taken up for cost estimates. However, the sample design drawn up for each region is in respect of the principal crop of the region. For the cost estimation of 'other crops' from a given region, like wheat region, rice region, millet region etc., separate sampling designs are not drawn up; the cost data of 'other crops' are collected by the concerned enumerators from the cultivators who are actually selected for studying the costs of the principal crops. For example, the cost of production
data in respect of, say, jute in West Bengal are not collected from a separate sampling design prepared for the jute growing holdings; on the contrary, West Bengal being a 'rice region' in CS, the data on cost of cultivation of jute are collected from the holdings selected from West Bengal for the study of the costs of cultivation of paddy. Therefore, it is possible that such 'other crops' for which costs of production are estimated from a given region need not necessarily reflect the actual behaviour that these would have shown, had their costs been collected from a sampling design specifically drawn for them.

For the purpose of selecting the samples, the 'stratification' is made as follows: a state is first divided into more or less homogeneous zones, taking into consideration the cropping pattern, status of irrigation, rainfall, type of soil, and so on. From these zones, a total of 20 to 50 first stage sampling units, i.e., tehsils, are selected. The number of tehsils selected depends up on the size of the state, area of the crop
under cultivation, and also taking into account the need for getting cost estimates at reasonable precision. Thus, in States like Punjab, Haryana, Kerala, Himachal Pradesh, and Jammu and Kashmir, the number of tehsils allotted for cost studies is 20 each, in Assam, Orissa and Karnataka it is 30 each, in Uttar Pradesh 50, and in all others 40 each.

The zone-wise distribution of the tehsils is made according to the proportion of area in each zone to the total area under cultivation of the particular crop in the State. To clarify: suppose, a State, to which 40 primary sampling units are allotted, is demarcated into three homogeneous zones for the study of, say, paddy cost, and the operational area under paddy in that State is distributed as 20 per cent in zone-one, 50 per cent in zone-two and 30 per cent in zone-three. Then, 9 tehsils will be selected from zone-one, 20 from zone-two, and 12 from zone-three, which make the distribution of the 40 primary sampling units, i.e., tehsils, proportionate to the operational area under paddy in each zone. As
regards the manner in which the 'tehsils' are allotted in each zone, it has been clarified in an official source that these are "randomly selected in such a way that their replacement and probability are proportional to the area of the crop under survey".  

Using the same probability principle, as stated above, a 'nucleus village' is selected from each tehsil. A cluster of three villages formed around the 'nucleus village' constituted the secondary stage sampling unit. Thus in our above example, where 40 primary sampling units are selected from a State, at the rate of 8 units from zone-one, 20 from zone-two, and 12 from zone-three, the secondary stage unit will consist of 120 villages, randomly selected at the rate of 24 villages in zone-one, 60 villages in zone-two, and 36 villages in zone-three.

Finally, from each cluster of villages, a list of operational holdings is prepared in ascending order of the size of holdings—the operational holding being

4. See, B.J. Kapre, op.cit.
defined as the area operated by a cultivator, or would be cultivated by a potential cultivator. These holdings are stratified into five size classes, in such a way that the operational areas of the holdings allocated in different strata are more or less equal. Then, from each stratum, (size-class) two holdings are randomly selected — that is, from each cluster of villages 10 holdings are selected randomly. To illustrate it to our earlier example, where a state is divided into three zones, and 40 primary sampling units (i.e., tehsils) are randomly selected, at the rate of 8 tehsils from zone-one, 20 tehsils from zone-two and 12 tehsils from zone-three, the number of holdings selected will be at the rate of 8 x 10 = 80 from zone-one, 20 x 10 = 200 from zone-two and 12 x 10 = 120 from zone-three, making a total of 400 holdings to be taken up for cost estimate of a given principal crop. This is for the detailed survey on the main sample. The sub-sample will consist of 25 per cent of the main sample; the method adopted for the selection of the sub-sample units is the same as that of adopted for the main sample.
2. A Comparison of CS Sampling
with FMS Sampling

FMS, as stated elsewhere, confined their investigations to selected districts. The data were collected under FMS by adopting a multistage stratified random sampling, with village as a primary unit and operational area as the ultimate unit of sampling. The district under study was first divided into different homogeneous zones based on soil type, cropping pattern, irrigation facilities, etc. From these zones, in all, 15 to 20 villages were chosen with probability proportional to cultivated area. The total holdings in these villages were pooled together and arranged in descending or ascending order, divided into 5 strata or size-class, and a total number of 150 to 120 holdings selected by allocating about 20 per cent of the total holdings in each stratum. In the initial years data were collected according to survey method. Afterwards it was replaced by cost-accounting method, that is, the figures on inputs and outputs were collected from the villages on the basis of day-to-day observations and contacts with the
selected cultivators. From the mid-sixties, until it was wound up, FMS were conducted in 11 centres, spread over 9 States. Out of these surveys, cost estimates on wheat are available in the reports for Deoria, Muzaffarnagar, Berosepur and Ahmednagar, and on paddy, in the reports for Thanjavour, Coimbatore, Cuddapah, Cuttack, Howgund, Noonfally, Surat/Bulsar, Deoria, and Muzaffarnagar. Except for Hooghly of West Bengal, and Ahmednagar of Maharashtra, where the studies were undertaken continuously for four years, in other centres the studies were conducted only for three years at a stretch. FMS data, thus lacked continuity and comparability over the years and across the regions. Moreover, some important agricultural states, like Haryana, Rajasthan, Madhya Pradesh, Bihar, Kerala and Karnataka, as well as the crops like oil seeds and pulses were not at all covered under FMS during the latter half of the sixties when APC entered in the market for agricultural products.

From the above, it can be seen that the sampling design followed by CS has some merits over FMS sampling design. Firstly, CS is spread over the entire country.
Every State which has at least 5 per cent of the operational area under a given crop is brought under the scheme. With the availability of this data, an overall view of the cost structure of a crop across the States and over the years can be had; this makes price fixing easier. Secondly, CS takes into consideration the necessity of statistically more representative data in respect of a crop in a given State, in spite of the heterogeneity of the agricultural areas in the State in terms of fertility, cropping pattern, irrigation, rainfall etc. That is why, in order to have the 'likelihood' of getting representation to all heterogeneous units of cultivation, the State is first divided into homogeneous zones, and then, the first stage, second stage and ultimate stage sampling units are randomly selected.

3. Collection of Data

At section-2 above it was indicated that FMS, in the initial years, followed 'survey method' and afterwards switched over to 'cost accounting' method for collection
of data. CS adopts cost accounting method. For the purpose of collecting field data from the selected cultivators, as and when various agricultural operations take place, village level Fieldmen are appointed, at the rate of one Fieldman for each cluster of villages. A Fieldman collects data on inputs and outputs, in monetary and physical terms, from all the holdings selected from a cluster of villages. Such Fieldmen are supervised by Field Supervisors and a Field Officer in each State, who visit the Fieldmen and give on-the-spot guidance to them. The data thus collected in the prescribed forms are sent to the Central Analytical Unit set up at the Directorate of Economics and Statistics, Government of India, which undertakes the processing, analysis and the final preparation of the report.\(^5\)

While processing the data, the input values collected in physical terms have to be converted into monetary terms. The items of inputs and services owned by the

\(^5\) See, B.N. Kapre, \textit{op.cit.}
cultivating households and used in cultivation necessitate imputation of values to these items. A few input items available with the cultivating households may not have established market value; some other owned input items may be having established market value, but may be used by poor and illiterate farmers who do not have the practice of keeping a record of the prices of the input items owned and applied by them in cultivation. To clarify this: cultivation of land requires seed, manure and fertilizer; water, power and electricity; tools, implements and machinery; insecticides, pesticides and weedicides; and, above all, land and labour. In addition to these, some of the durable items of inputs which are being maintained on the farm site itself, such as, store-houses, farm-buildings, irrigation structures etc. also form part of the cultivation process.

An input item may be wholly or partly used from the domestic sources, an account of any of the following reasons: (i) the household may be poor, so that it cannot afford to buy from the market any costly inputs;
(ii) the household may have enough economic capacity to cultivate its land with purchased inputs, but the land on which to cultivate may not possess the infrastructural facilities required to make use of the purchased inputs; or (iii) the input may be available with the household, so that there is no need for purchasing it from outside. Whatever be the reason for the use of owned inputs or services for cultivation, a realistic cost estimate has to evaluate these items and include them in the cost of production.

Some such inputs may be used for the cultivation of more than one crop or more than one season, which necessitate the apportionment of those 'joint-costs' among individual crops. Farm buildings, like, cattle sheds, storage sheds etc., implements and machinery, maintenance charges for bullocks, rent for the leased-in land and rental value of owned land, land review, cesses and taxes, interest on owned fixed capital, etc., are some of the joint-costs which have to be apportioned between individual crops. We will address ourselves, in what follows, to the procedure adopted for evaluation of inputs
and allocation of joint costs, by taking each item separately.

(a) Labour:

Of all items applied for cultivation, the most important one is labour, as far as its share in the total cost is concerned. (This is shown in the next chapter). In one sense, it is the most complicated input too, if we look at the labour practices prevailing in agriculture in different parts of the country. The principal types of labour used in cultivation according to CS are (i) human labour; (ii) bullock labour, and (iii) machine labour. To take human labour first, it may be hired from outside or may be available with the cultivating households. The hired labour may be in the form of casual labour; it may also be in the form of permanently attached labour.

The hired labour is paid wages in cash or in kind. There are, however, wide variations in the determination and payment of wages in different parts of the rural countryside. In every part of the country child labour
is engaged in cultivation either as attached labour or as casual labour. The adult labourers may be male labourers or female labourers. Women labourers are engaged in agriculture for certain specialised types of functions, such as, sowing of seeds, transplanting, weeding etc. On the other hand, there are certain specialised categories of work which are exclusively earmarked for male labourers, for example, ploughing, digging, manuring etc. During peak periods of agricultural operations, the works done by female labourers in normal times may be done by the male labourers, and vice versa, depending upon the availability of different types of farm workers in each region. Still, the wage rate for male and female workers follows a certain conventional pattern. For example, if a predominantly male type labour is carried out by female workers, the wage paid to the latter will be lower. Conversely, if a predominantly female-type work is done by the male workers, they are paid a higher wage.

The casually hired labour has to be distinguished from the family labour and the attached labour. The
casual workers are appointed for some specific work in agriculture. But the family labour and the permanent farm servants attached to the cultivator do agricultural operations along with other household works.

The official estimates, i.e., both CS and FMS, take into consideration all these aspects while accounting human labour charges. In order to have uniformity in estimation procedure, human labour power—that is, male labour, female labour and child labour—is standardised into one single unit, viz., man-day. A man-day is taken to be equivalent to eight hours' work of an adult male labourer. Generally, either of the following two methods is adopted to convert woman and child labour into man-day. For instance, suppose the average daily wages for men, women and children are, respectively, at the rate of, say, \( \frac{x}{y} \), \( \frac{x}{z} \), and \( z \). Then, \( \frac{x}{z} \) child labour days = one man-day; \( \frac{x}{y} \) woman labour days = one man-day, due to the obvious reason that the wages for women workers and child workers are less than the wages for male workers. The second method is to apply a fixed ratio, say, 2 woman-days = one man-day; 3 child-days = one man-day; and 8 hours of adult
male work = one man-day. After making conversions in either of these two methods, the total man-days of hired labour worked out for a given holding is multiplied by the actual market wages to arrive at wages for hired labour on that holding.

Then, the owned labour: the small peasants mostly use their family labour for cultivation because of the abundance of it with them relative to their operational area. The big farmers may not generally use their family labour to do the works that the other wage workers do. However, they have to draw the services of their family members occasionally. During periods of peak agricultural operations, it would be difficult, at least in some areas, to find sufficient wage labour, as the demand for labour at such times outstrips the supply of labour available for hire. If the specific agricultural operation has to be completed within the requisite time period, these farmers have to then press into service the labour available with them and their families. Further, there are certain agricultural operations which require special care or skill, that may not be available with the
attached labour, nor can it be available for hire; for example, handling of sophisticated machinery. Such works are done by the rich farmers by themselves or by their family members.6

In short, family labour use in agriculture, loosely defined to include any kind of work done on the field, can be seen on all classes of cultivating households. Moreover, though the ratio of family labour use to total labour use may be the highest on the smallest holdings, (as little or no outside labour is used on these holdings) and the lowest on the larger holdings, the total family labour-days per farm is observed to on the increase along with the increase in the farm size upto a certain level; afterwards it again decreases,7 probably implying that among the larger holdings, the landlord farmers etc. do not make use of much of their family labour power on the farms. These services of the family members also


7. Utsa Patnaik, "Neo-Populism and Marxism", op. cit., (see col. 6 and 7 of Table-I in Part-II of the paper).
have to be evaluated and added in cost estimates. There is no unanimity regarding the method to be followed for the imputation of wages to the family labour. National Commission of Agriculture, which examined this aspect in its interim report on price policy, gave the following comments on the three existing views regarding the method of imputation of wages to family labour:

One view was that the family labour should be valued on the basis of the prevailing wage rate for casual labour. This view was objected by National Commission on Agriculture on the ground that wages for casual labour are generally higher than the permanently attached labour as they are employed mostly in peak seasons. They have to remain without employment for many days in a year. During these days of unemployment the casual labourers have to depend upon the wages earned while at work. If the wage income of the casual labourers are distributed over the whole year, the rate of daily wage may not be significantly higher than that is received by the attached labour.

The second view was that the wages for family labour should be imputed at the rates of comparable wage for rural industrial workers. This was also unacceptable to National Commission on Agriculture: The industries are fairly well organized. The wages of industrial workers are protected through collective bargaining and trade unionism. The wage rates in these industries would, therefore, be necessarily higher. The agricultural operation cannot be equated with organised workers of rural industry for the purpose of wage calculation. In this respect, perhaps, it may be argued that wages of family labour, rather than equating with those in the organised rural industries, can be equated with the wages in unorganised rural industries. But in many areas there may not have such industries. Wherever there are such rural industries, the wage rates for unskilled labourers may not be noticeably different from those given to the attached farm servants. This will be particularly so because of the existence of surplus labour in rural countryside.

The third view was that the wages for family labour should be evaluated at the statutory minimum wages in each
region. This could have been an acceptable basis for evaluation of family labour, provided the statutory wages had any relevance either to the going wages or to the cost of living of the people in the areas. In most of the areas the statutory minimum wages are not revised according to the economic realities of the changing times. Wherever these are revised, the agricultural labourers fail to obtain it from their employers, provided the former are not fairly organised.

Considering all these aspects, National Commission on Agriculture, reiterated the method adopted by FMS and CS for imputation of wages to family labour, i.e., in these studies, the family labour charges are determined according to the rate of wages available to annual farm servants. If a particular land holding taken up for cost observation does not have attached farm servants, the average rate of wages prevailing for such labourers in the locality is taken by both FMS and CS to evaluate the family labour.

Wages in all rural areas are not fully monetised. The casual labourers may be paid a part of the wage in
cooked meals, or grains. The wages to the attached farm servants may consist of grains and cooked meals, clothing, medicine, festival gifts, etc. All these items are to be converted into money and added to the estimates of human labour charges. Cash values of these items are worked out according to their local market prices, or the actual amount spent on these items as recorded by the respective cultivating households. In some areas attached labourers are provided with hutments by the cultivators. In such cases the estimated rental value of the hutment is also added to labour charges. Thus, after working out the value of human labour days spent on a holding for the cultivation of a given crop, by taking into account the wages actually paid, the wages imputed, and the monetary value of physical items provided to the work force on the farm, its break-up between casual, attached and family labour is estimated.

Another item of labour charge that is added to the cost is the payments made for bullock labour. The cultivator may use his own bullock labour or hired bullock labour for works like preparation of land, irrigating soil from the
well, transporting inputs and outputs, and so on. In the case of hired bullock labour, the actual payment made for the services rendered on the farm is taken. The charges for owned bullock labour are estimated from the net maintenance cost incurred by the cultivator on his draft animals, for example, his expenses on green and dry fodder, cost of concentrates, veterinary expenses, depreciation charges for cattlesheds and fodder sheds, upkeep labour charges, etc. There are two points to be noted in this respect: (i) The cultivator will be owning milch animals along with draft animals. He does not incur the maintenance expenses on both these animals separately. For the purpose of cost of cultivation, however, only those maintenance expenses which are incurred on draft animals have to be taken into consideration. (ii) The use of draft animals owned by the cultivator may not be restricted to any single crop, but to all crops cultivated by him. The total maintenance cost should therefore be apportioned between milch animals and draft animals, and the latter among different crops for which the services of the draft animals are applied.

The apportionment of maintenance costs between draft and milch cattle is made after reducing the total
number of animals owned by the farm household into standard animal units, which are expressed as:

(i) bullock, cow, buffalo and horse above two years = one animal unit; (ii) camel above two years = two animal units; (iii) sheep and goat = one-fifth of an animal unit; and (v) young stock below one year = quarter of an animal unit. The total maintenance charges incurred by the cultivator are converted into charges per animal unit. This value is applied on the total animal units of the draft cattle.

From the gross bullock labour charges computed, as explained above, out of the cost of fodder and concentrates, upkeep labour charges, other expenses, if any, etc., the value of dung produced by the animals and the receipts from hiring out are deducted, to obtain the net maintenance cost of draft cattle. The share of draft animal cost to each crop is allocated in relation to the hours of bullock labour service rendered to the concerned crop.

Cost estimates available in CS give break-up of one more component of labour charges namely, machine labour. The component, perhaps, cannot be considered as labour
charge in the strict sense of the word. By the term 'machine labour' CS means expenditure on maintenance, repair, operation as also depreciation charges of the machinery used in cultivation. The method adopted for estimating machine labour is as follows: The rate of expenditure per hourly utilization of implements and machinery in cultivation is worked out from their maintenance and repair charges. To this amount is added their depreciation charges per hour, estimated from their expected service period and operation charges. For the purpose of estimating depreciation charges, machinery are classified as 'major implements' and 'minor implements'. The former include tractor, pump-set, electric motor, oil engine etc. All traditional implements are grouped as 'minor implements'. Usually, the implements classified as 'major' are depreciated at 10 per cent per annum and those classified as 'minor' at 5 per cent per annum. The hourly expenditure so estimated — that is, the expenditure on maintenance, repair, depreciation, etc. — is applied to total hours of machine use for a given crop to obtain the machine
labour charges for that crop.

(b) Variable Physical Inputs:

These are seeds, insecticides and pesticides, fertilizer and manure, water for irrigation etc. Some of these inputs have to be exclusively, purchased from outside. For example, HYV seeds, insecticides and pesticides, fertilizer and irrigation water. Conventional seeds, organic and farm yard manure, etc. may be partially or fully owned by the cultivator. Purchased parts of the inputs like seeds and seedlings, insecticides and pesticides, fertilizers and manures etc. are accounted at the actual price paid by the cultivator. Farm yard manure, green manure, conventional seeds, etc. which are used by the cultivators from owned sources, are valued at the market price prevailing for identical items in the locality. If the cultivators are not aware of the market price of their owned inputs, the enumerators gather such information from reliable and well-informed sources in the concerned locality.

(c) Land, Capital and Other Farm Assets:

The selected holding for cost study may be either an owner-operated land or partly or wholly leased-in.
For the leased-in part of the holding, rent is actually paid by the cultivator according to the tenancy agreement. For the owned part of the holding 'rent payable' is calculated according to any of the following three methods: (i) in proportion to the rent prevailing for identical land in the cluster of villages selected for cost estimates (ii) certain per cent of the total value of the main products and by-products grown on the sample-holding, or (iii) the prevailing interest on the capital value of owned land. If the rental value of owned land is proposed to be estimated according to method (iii) then, the value of land is estimated at the rates prevailing in the selected cluster, taking into account the differences in the type of soil, distance from village, source of irrigation, and so on. 9 Apart from land, the cultivator may be having machinery, implements and other items of fixed capital assets, like, irrigation structures, shore-houses, cattle-sheds, fodder-sheds, etc. When these fixed capital assets are put to use in

production a part of their value, which was paid by its owner in one sum gets gradually transmitted in the output of land. After a certain period, the use value of these capital assets is exhausted completely. If the production process has to continue afterwards, the capital assets have to be replaced. With this end in view, the cultivator's owned capital assets like implements and machinery, irrigation structures, store-houses, cattle-sheds, fodder-sheds etc. are allowed depreciation charges in the estimated cost.

In order to determine the value of depreciation of a capital asset, we should first ascertain the total time period required for the 'use-value' of the capital asset to be completely absorbed in production. Though this can be known accurately only at the end of the life of the capital asset, it is normally calculated according to any of the following two methods: (i) reducing balance method; (ii) the straight line method. In reducing balance method depreciation is calculated at a constant 'production' of the cost of capital asset, i.e., a diminishing annual absolute amount. In the straight-line
method, the estimated residual value of the capital is deducted from its original cost and the balance equally divided by the number of years of the expected life of the capital item. It is this latter method that is generally adopted to estimate the depreciation charges of capital assets to be included in agricultural cost estimates under CS and FMS. If the original cost of a capital item is not known, the market price of that item prevailing at the time of estimating the cost is taken into consideration. (Since prices of these assets are expected to go up over the years, this portion of the cost should be an over-estimation).

Apart from the depreciation charges allowed for capital and assets, the cost estimates also include interest charges on working capital and fixed capital. In order to estimate the interest charges, the capital value of the fixed assets are estimated at prevailing market price. And a long-term rate of 6 per cent per annum on the present value of fixed assets, like, farm buildings, implements and machinery, irrigation
structures and equipments, draft animals etc. are added in the estimated cost. (However, the value of owned and self-cultivated land is not taken into consideration for computing interest on owned fixed capital, because it is supposed to be included in the rental value of owned land). Interest is allowed also on working capital, i.e., the money value of cash and kind expenses, other than post-harvest payments like land rent, land revenue, cesses, taxes, etc. Thus, estimated amount of expenditure on wages paid for hired labour, seeds, fertilizers and manures, insecticides and pesticides, irrigation, etc. is allowed a short-term rate of 10 per cent per annum.

(d) Off-farm Payments:

There are a few items of payments made by the cultivators which, in the strict sense, cannot be considered as cost. For example, payments made to artisans, taxes, cesses, land revenue, land rent, and so on. Though these do not form part of inputs applied for cultivation, these expenses cannot be avoided by the cultivator who wants to carry on agriculture. Since the amounts required for
such payments have been made "in the pursuit of 
cultivation", it should be compensated in the price 
received for the cultivators' output. In order to take 
care of this aspect in the procurement price, the 
estimated cost takes into consideration the actual payment 
made towards cesses, taxes, land revenue, artisan's 
payments, and so on.

(e) Apportionment of Joint Costs:

Some of the items of inputs and services applied 
in cultivation relate to mixed crops, or only to a portion 
of the farm selected for cost/estimates. The expenditure 
on such items actually incurred, or imputed, has to be 
allocated to each crop. The important items of inputs 
and services which have to be apportioned between 
different crops grown on the same landholding are the 
expenses on owned bullock labour, family labour and 
attached labour; depreciation on farm buildings and 
implements; rent on leased-in land and rental value of 
owned land; land revenue; cesses and taxes; interest on
owned fixed capital etc. We have seen earlier that the
apportionment of human labour between different crops
is made on the basis of the value of human labour days
spent on each crop. We have also seen that the share of
drought animal cost, as worked out from the net maintenance
cost of owned bullock labour, is allocated to each crop
in relation to the hours of bullock labour service
rendered to the concerned crop. Similarly, the deprecia-
tion of farm buildings, land rent, land revenue, cesses
and taxes, interest on owned fixed capital etc. are
allocated in proportion to the area under each crop in
the selected farm. Depreciation of implements, on the
other hand, is apportioned in proportion to human/bullock
labour inputs in each crop. In case necessary data in
this regard is not available for the whole year,
depreciation charges on implements are apportioned in
proportion to the area under the crop.

Sometimes apportionment of joint costs between
crops according to proportionate area under the crops
may not be possible, if the crops are cultivated as
'mixed crops'. For example, in certain areas in Punjab
wheat crop is mixed with other crops like gram, barley, lentil, rapeseed etc. and in Uttar Pradesh, in addition to these crops, wheat cultivation is mixed with linseed and peas; wheat in Maharashtra is mixed with sunflower. In Eastern and North Eastern States like West Bengal, Assam, etc., paddy crop is mixed khesari, jute, maize, chillies, etc, and in southern States like Kerala paddy is mixed with ragi. In such cases the proportionate value of output of a given crop to the total value of all crops grown in the landholding, estimated at farm market prices, is applied for apportioning the joint-costs.

4. Method of Estimating Unit Cost

In the previous section we saw how the holding-wise data on items of inputs are enumerated, values and apportioned between crops. The values of inputs so obtained for each holding have to be converted into unit costs, i.e., cost of cultivation per hectare, and cost of production per quintal of output. Published information

of cost estimates, as per CS, shows that average costs per hectare and per quintal are available in break-ups of input items, like, human labour (casual, attached, family), bullock labour (owned, hired), machine labour (owned, hired), seed, fertilizer, manure, insecticides and pesticides, irrigation charges, interest on working capital, rental value of owned land, rent paid for leased in land, land revenue, cesses and taxes, depreciation on implements and farm buildings, and interest on fixed capital. These items are given separately as operational costs, fixed costs and total costs per hectare on the one hand, and as Cost A1, A2, B and C in terms of cost of cultivation per hectare and cost of production per quintal on the other. Information is also given in respect of yield per hectare, value of main-product per hectare, and value of by-product per hectare. We may now see how these values are arrived at.

It has been pointed out earlier that the data on costs are enumerated or estimated initially for one year from the main sample, followed by a sub-sample
survey for a few years. Let us take first the estimation procedure for the main sample: Firstly, the cost of cultivation per hectare, yield per hectare, the value of by-product per hectare and the value of yield (main-product) per hectare are estimated for each holding of the cluster along with the break-ups of inputs as well as concepts like Cost-\(A_1\), Cost-\(A_2\), Cost-\(B\) and Cost-\(C\). Then, the average cost or any other value like average yield etc. for the cluster is estimated by using the area under the given crop in each size class (selected as well as others) as weights. Once the estimates are made for each cluster, the zonal level and state-level estimates are worked out as a simple average of the cluster level estimates. To be more specific, suppose the cost of cultivation and the area of a given crop under study, in respect of a given size-class, in a holding selected from a given cluster are respectively \(X_{ijkl}\) and \(A_{ijkl}\), where the subscript \(i\) stands for the given holding, \(k\) for the size-class, \(j\) for the cluster and \(i\) for the zone. Then, the cost of cultivation per hectare of that given

\[ 11. \text{I am indebted to B.N. Kapre, op.cit., for the methodology given below.} \]
size class is estimated in the following method:

\[
\frac{2}{\ell} \sum_{k=1}^{2} X_{ijkl} + \frac{2}{\ell} \sum_{k=1}^{2} A_{ijkl} \]

(1)

After estimating the cost of cultivation per hectare for each size-class in the cluster, as given above, the average cost of cultivation per hectare for the cluster as a whole is worked out as given below:

\[
\frac{5}{k_{ij}^{\text{total}}} \sum_{k=1}^{5} X_{ijkl} \left[ \frac{2}{\ell} \sum_{k=1}^{2} A_{ijkl} + \frac{5}{k_{ij}^{\text{total}}} \sum_{k=1}^{5} X_{ijkl} \frac{2}{\ell} \sum_{k=1}^{2} A_{ijkl} \right] \]

(2)

where \( X_{ijkl} \) is the total area under the crop taken up for study in size-class \( k \) of the cluster \( j \) of the zone \( i \).

From the cluster-wise average cost of cultivation so estimated, by using the total area under the crop in each cluster as weight, we can now work out the cost of cultivation per hectare for the zones and the state as a whole. Accordingly, the per hectare cost for the zone \( i \) which is only a simple average of the costs for the total number of clusters in the zone may be written as

\[
\frac{1}{ni} \sum_{j=1}^{n_{ij}} y_{ij} \]

(3)

where \( ni \) is the number of clusters selected for cost study in the zone \( i \). Suppose, we can write the expression
given at (3) above as \( y_1 \), and there are \( m \) number of zones selected from the State, then the average cost of cultivation per hectare for the State can be written as:

\[
\frac{\sum_{i=1}^{m} n_i \cdot \bar{y}_i}{\sum_{i=1}^{m} n_i} \cdot \bar{y}_1 \quad (4)
\]

This, in other words, is the simple average of the average costs estimated for the total zones in the state.

Using the same methods given at expressions (1) to (4), the yield per hectare for the crop under study is estimated for the size-class, cluster, zone and the state. Now, with the estimates of cost of cultivation per hectare, (according to different concepts) and the yield per hectare, the estimates of cost of production per quintal at different levels are arrived at, by dividing the cost of cultivation per hectare (net of the value of by-product), according to different concepts, with the value of the yield per hectare.\(^\text{12}\)

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12. The procedure adopted for estimating cost of production per quintal in FMS is slightly different. To clarify, if we can denote cost of production per hectare as \( Y \), the yield per hectare as \( y \), the value of main-product as \( m \), and the value of by-product as \( b \), then the cost of production per quintal, according to FMS is given as \( (Y/b)/(m+m+b) \), whereas the same according to CS is expressed as \((Y-b)/H\).
Then, the cost estimation for the sub-sample:

We have clarified earlier that the sub-sample survey consists of 25 per cent of the holdings in the main sample. Thus, in a state where 40 tehsils are selected in the main sample for cost estimates in the initial year, there will only be 10 tehsils in the sub-sample for subsequent years for cost estimates. If we estimates the sub-sample costs as such by adopting the methods suggested for the main-sample cost estimates, it would not give us cost data comparable to, and as comprehensive as, the main-sample cost. In order to make the cost estimates available from the sub-sample as representative and comprehensive as the main sample data, and also to make both these data comparable to each other, the following method of estimation is adopted: In the first instance, cost per hectare of different items of inputs are worked out for the sub-sample, in respect of each size-class of holdings, cluster of villages, and zone. The method of calculation of these figures is the same as indicated in the expressions (1) to (3). In the same way, the corresponding figures of input cost per hectare
for different items of costs are worked out for the size-class, cluster and zone in the base year. To clarify further, suppose the state taken up for the cost estimates under CS is allotted 40 clusters in the main sample, and that these 40 clusters are randomly selected from 3 homogeneous zones. Again suppose that, with reference to replacement and probability proportional to the area under cultivation of the principal crop, the first and second zones get 16 tehsils each and the third zone gets 8 tehsils in the secondary stage sampling units of the main sample. Then, following the same sampling rules, the sub-sample will get 10 clusters (25 per cent of the main sample) distributed at the rate of 4 tehsils each in zone 1 and 11 and 2 tehsils in zone-III. Since these 10 tehsils are selected from among the 40 tehsils belonging to the main sample, CS, for the first instance, estimates per hectare costs for the three zones during the base year and the subsequent year for the holdings selected from the 10 tehsils of the sub-sample, which are also available in the main sample. Thus, when the sample average costs per hectare (with break-ups) are
worked out for the sub-sample clusters in three zones, in respect of base period and the subsequent period, the zone-wise estimate for the year under study is related to those in respect of the base year. The estimates for both periods being based on the same cluster, the difference between the two estimates indicates the difference in costs, for the clusters over the two years. The difference of costs so obtained (as a ratio or percentage) is then applied to the zone wise estimates generated for the base year on the basis of the complete sample studies. To be specific, let us say that $S_{ij}$ is the sub-sample cost per hectare of the cluster $j$ in zone $i$, $S_{ij}$ is the corresponding cost per hectare of the main sample for cluster $j$ of zone $i$, and $S_i$ is the total cost per hectare of all clusters in zone $i$, then the cost of cultivation per hectare, $S_i$, for zone $i$ during the year under study is estimated by the following method:

$$S_i \left[ \sum_{j=1}^{L_i} \frac{L_i}{j} S_{ij} \right] \frac{1}{j} \left[ \sum_{j=1}^{L_i} S_{ij} \right] \cdots \cdots \cdots \cdots (5)$$

where $L_i$ stands for the number of sub-sample clusters selected from the zone $i$. 
The zone-wise estimates of cost per hectare arrived at, as explained by the expression (5) above, are then weighted in proportion to the area under the crop in the different zones to derive the estimates of cost per hectare at the state level during the year under study. If we denote the area under the crop in zone i, as $A_i$, (where the cost per hectare is estimated at $S_i$) and the number of zones as $M$, then the cost of cultivation per hectare, $S$, for the state during the sub-sample period is estimated by using the method:

$$\frac{\sum_{i=1}^{M} (A_i \cdot S_i)}{\sum_{i=1}^{M} A_i} \cdot \sum_{i=1}^{M} A_i \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ ld
determination. The scheme as originally designed proposes to study, in addition to computation of estimates of cost of production of all crops grown in the selected holdings, along with their detailed break-ups, the farm business income from crop production, yield response to fertilizer use in different size-classes of holdings, pattern of employment of family labour, marketed surplus and market dependence of the cultivating households in different holding ranges, etc. In addition to these, CS proposes to collect data on costs and returns of two "progressive farmers" from each selected size-class, randomly or purposively.\(^{13}\) Even though there is no evidence from the published sources that APC is receiving all these details, the collection and processing of cost of production per unit of area and output, along with its break-ups from all the major producing states simultaneously would involve huge volume of work.\(^{14}\) Some

\[\text{\textbf{\textsuperscript{13} B N. Kapre, op.cit.}}\]

\[\text{\textbf{\textsuperscript{14} It has been reported that, when Directorate of Economics and Statistics, Government of India received data from 16 States, they had to punch 5 million cards for the purpose of processing these data. B K. Kapur, op.cit.}}\]
time-lag in the availability of these data for the use of APC cannot therefore be ruled out. Generally, these data reach APC after, at least, two seasons from its actual collection.

Since APC has to recommend price policy for each major crop on the eve of its harvesting season, the cost data that is received after such a long time-lag is of not much use. However, APC has been using these data, after taking into consideration the changes which have taken place in the prices of the inputs, subsequent to the availability of the unit cost of production.

In order to estimate the change in cost above the estimated cost for a given period, APC has been using some composite index of input prices, prepared by itself. In one of its earlier reports, APC has shown how the indices of input prices have been estimated by it and applied on CS cost estimated and provided to it with respect to a previous year, to arrive at an idea about the probable level of cost during the 'current' agricultural
production season. At the time of giving thought to the price policy for kharif cereals for 1974-75 marketing season, the cost estimates on paddy available to APC was with respect to Andhra Pradesh in 1971-72 and Orissa in 1972-73, whereas for the determination of procurement prices of paddy what APC required was the cost of production estimates for 1974-75 kharif crop.

Therefore, APC estimated a composite index of input prices of paddy, as a weighted average of the index numbers/indicators of prices in respect of hired human labour, bullock labour, seeds, fertilizers and manures, pesticides, depreciation on implements, machinery and farm buildings, operating cost of machinery, irrigation charges, interest on crop loans and working capital and other items for 1971-72, 1972-73, 1973-74 and 1974-75. The weight for each item has been estimated from the expenses reported for these items in FMS for the States of Andhra Pradesh, Assam, Orissa, Punjab, Tamil Nadu and Uttar Pradesh for 1968-69 and 1969-70. The weighted index so estimated has been applied on the paddy cost for Andhra Pradesh and Orissa to see what would have been the costs for 1974-75 kharif crop, as a result of the change in prices of the items of inputs mentioned above.