CHAPTER 8
SUMMARY AND CONCLUSIONS

Agriculture is the largest sector in the Indian economy in terms of percentage of total population economically dependent on it. The optimum use of agricultural resources can increase agricultural production, productivity and profitability that may have direct impact on the living standard of rural masses. Low labour productivity in agriculture in which nearly two thirds of our labour force work is largely responsible for widespread poverty. Agricultural development is thus very important not only for our food security but also for eradication of poverty.

A modest attempt has been made in this thesis to examine resource use patterns and resource use efficiency in West Bengal’s agriculture in terms of both partial and overall measures of productive efficiency based on aggregated and disaggregated data at secondary and primary levels.

In agriculture most of the production relation are land centric. The crucial terms such as farm size, yield rate, cropping pattern, cropping intensity, land leasing, tenancy status, rent, structural change in agriculture, soil management etc. used in the analysis of agricultural production economics are closely related to land use efficiency. If fertile agricultural land is taken away for industrialization or urbanization without absorbing surplus agricultural labour in a densely populated country like India the land-man relation may deteriorate both quantitatively and qualitatively.

Distinction between hired labour and family labour manifests duality in the agricultural labour market. Whereas cost of family labour with little opportunity cost may be fixed in nature (as family labour has to be maintained anyway irrespective of the volume of output) with marginal cost equal to zero, hired labour involves variable
cost. Thus whereas family labour may be used so long as its marginal productivity is
positive, hired labour may not be engaged when its productivity goes below the
appropriate wage rate. But at the same time family labour is directly interested in the
overall performance of the farm whereas the hired labour may not have such interest.

Progressive Indian agriculture needs significant expansion of irrigation
facilities. Diversion of government funds from augmentation of irrigation facilities to
finance high rates of fertiliser subsidies representing a highly water-intensive
technology may adversely affect sustainable availability of water for sustainable
agricultural development. Chemical technology also tends to adversely affect the
environment and ecological balance. Productivity effect of this technology is also
tapering off. Given the chemical technology, soil testing may result in lowering of
recommended dose of fertiliser use and may thus reduce water consumption, paid-out
cost (which may need higher rate of borrowing) and unit cost of production. Research
may be conducted to develop non-chemical ingredients of plant nutrition. Organic
manures may be equally productive, less water intensive and more soil friendly.
Further, production of organic manure like cow dung manures, vermin composts,
processed sea weeds of particular varieties is decentralised and may open up avenues
of considerable employment for production and provision of environment-friendly
plant nutrients. Research and extension services to develop suitable varieties of
various crops according to the quality of soils and availability of water should be
promoted to substantially increase return from land. Research should also be directed
towards improving the yields of ecologically adjusted traditional varieties which
should not be allowed to vanish due to continuous non-use.

Mechanisation can be viewed in terms of farm size, unemployment problem,
level of economic development, rates of use of other resources, cost of production,
diversification and commercialisation of agriculture, specialisation of work, accessibility of credit, etc. Mechanisation which improves the productivity of labour without displacing them crop-wise may be welcome. It should be remembered that the social cost of machine which displaces hapless labour may be higher than its private cost; on the other hand, social cost of labour is less than its private cost since employment is the only source of return to the poor man's only asset, i.e., labour.

The concept of efficiency as understood and elaborated by authors like Debreu, Koopmans and Farrell has been examined in this thesis. Farrell's diagram regarding measurement of efficiency in terms of cost has been extended to measure efficiency in terms of output as well. A situation may be considered as efficient if there is no alternative situation where there is some gain somewhere without any loss anywhere. Farrell has distinguished between 'technical efficiency,' 'price efficiency' and 'overall efficiency'. Technical efficiency measures a firm's success in producing maximum output from a given set of inputs. Price efficiency measures a firm's success in choosing an optimal set of inputs. The product of technical efficiency and price efficiency is the measure of overall efficiency. If in an observation the cost of producing a given level of output is greater than the relevant minimum cost then the minimum cost/actual cost may be a measure of (in) efficiency in terms of cost. Further when in an observed point, a given output is produced at a cost which is capable of producing a much higher level of output, then the actual level of output/maximum possible output (for a given cost) is also a measure of (in) efficiency in terms of output. Efficiency may be viewed as a relative term which lead to comparative performance judgement of different units of production and its measurement requires a norm (or standard) by which comparison is to be made. The
average may be taken as the standard or maximum in case of output and minimum in case of cost may also be taken as the standard.

We have also considered two widely used approaches for the measurement of efficiency — one is deterministic approach and another is stochastic approach. In both these approaches, the recent thinking on standard is popularly known as frontier analysis where maximum is used as the basis for comparison.

Data Envelopment Analysis (DEA) is an important mathematical programming and non-parametric method of evaluation. It uses the concept of a frontier to measure efficiency. This method involves the use of linear programming to construct a non-parametric piece-wise frontier by connecting points of 'best practices' units over the data and relative performance of different units are judged compared with this frontier envelope. This method does not require assumption of a specific form of production function. There is a very useful computer programming (known as DEAP) developed by Tim Coelli for the purpose of calculating efficiencies in production. DEA can be viewed in terms of both inputs (usually called input-oriented measures of DEA) and outputs (termed as output measure of DEA). On the basis of this analysis, technical, allocative, cost or economic efficiencies and scale efficiencies may be estimated based on different assumptions regarding returns to scale (constant/variable) Stochastic Frontier Analysis (SFA) is another method of measuring efficiency. The economic logic behind the development of stochastic frontier production function is that the disturbance term ($\varepsilon_i$) is decomposed into two economically distinguishable random disturbances with different characteristics. First part of the disturbance ($v_i$) is pure white noise and the second part ($u_i$) reflects technical and economic (in) efficiency. The stochastic frontier function is an important method widely used in different fields that have considered the concept of
maximum as standard for measurement of efficiency. It is an important econometric tool for measuring farm level technical efficiency. Recently an alternative efficiency estimation approach utilizing generalised maximum entropy (GME) that combines the strengths of both DEA and SFA has been developed. In this analysis 3σ rule has been applied to identify two-sided error (random disturbance) support points. The maximum possible output is used as the yardstick in frontier approach and is obtained through the application of DEA method in case of deterministic approach and MLE estimation of stochastic frontier production function in stochastic approach. The yardstick may be determined on application of the ‘three sigma rule’ in respect of the concerned variable on the basis of what may be achieved by sample farms or units. For normal distribution mean ± 3σ include about 99 per cent of the observations. The ‘three sigma rule’ states that the probability for a random variable, with mean μ and variance σ², falling away from its mean by more than 3σ is at most 5 per cent. Since cost has to be minimised, the three sigma rule implies that standard average cost (c*) be taken as equal to mean of c_i's minus 3 standard deviation of c_i's. Further, in respect of output, which has to be maximised, mean plus 3σ may be taken as the standard. Our rule suggests that the performance of a particular farm may be evaluated in comparison with the best achieved among 99 per cent (95 per cent) of the peer farms.

Marginal analysis may also enable us to measure input specific efficiency. The input specific efficiency measure is based on the relation between the marginal value product (MVP) and the input price (P^f) in each farm. The rational state of the farm in specific input use may be defined as MVP = P^f. The ratio MVP/P^f or the difference MVP - P^f = D may be considered in the context. In respect of D, t-test may be applied to test whether D is significantly different from zero or not and also to examine the direction of the difference.
On the basis of different concepts of cost formulated by the Government of India different types of income may be distinguished: 1. Net Income from the farm business which is shared by the landlord, the farmer and the members of his family; 2. Net income from farm business accruing to the farmer and his family; 3. Enterprise income of the farmer and his family; and 4. Farmer's labour and management income which is a commercial concept.

A distinction has also been made between Paid-out cost (which involves payment to outsiders) and Retained Cost (which does not require any payment to outsiders, which are on account of farm level inputs, particularly family labour, and which also represents factor ownership income as distinguished from enterprise income of the farm).

The farmer is really interested in total income from the farm business. Such income includes both enterprise income and factor ownership income (particularly that on account of family labour). This total income is known as Farm Business Income which is the difference between Total revenue and Paid-out Cost.

While the operator's labour and management income (total revenue-total cost) may be negative, his farm business income (total revenue-paid-out cost) may very well be positive. Thus, in spite of negative income, the farmer faced with little exchange value of his endogenous inputs, particularly family labour, may cling to farming so long as value of output exceeds paid-out cost. But when due to some adverse circumstances paid-out cost cannot be recovered the farmer becomes entangled in debt trap and insolvency. All farmers are not emotionally equipped to bear the burden of destitution.

Among the determinants of farm income we have particularly considered and used two factors viz. Crop Yield Index (CYI) and System Index (SI).
Crop Yield Index is the measurement of the relative performance in respect of the rate of production of a farm deriving its income mainly from a variety of crops. For calculating CYI we need the following information (i) kinds of crops grown on the concerned farm; (ii) land area devoted to each crop on the farm; (iii) yield rate of each crop on the farm; and (iv) average yield rate of each crop in the region.

The System Index is a measure of the relative performance or efficiency of a farm specifically in respect of the selection and combination of enterprises and, for that matter, the cropping pattern. A farming system may be considered as characterised by the (feasible) enterprises that are included in it. Each farm adopts the farming system, of which it is a part, in its own way. The relative performance of a particular farm in this respect may be measured by the relative value of potential production (as distinguished from actual production) of the farming system on the farm as compared with the average value of potential production of the farming system in the region per unit of land area.

Cropping intensity is the ratio of Gross Cropped Area to Net Cropped Area. Where net cropped area tends to decrease due to urbanization and industrialization, the importance of cropping intensity as a factor in total income substantially increases. The increase of Gross Cropped Area is, no doubt, important for greater production, farm income and employment but also important is its structure or composition at least from the viewpoint of sustainability and profitability of agriculture. Cropping pattern describes such structure or composition of Gross Cropped Area. The pattern of land use in agriculture in a region is mainly described by the system of cropping pattern in that region based on action and interaction of various factors such as quality of land, farm size, structure of the other available resources, socio-political and institutional framework, infrastructure facilities.
available, level of technological development and linkage with other sectors of the economy.

In order to measure the diversity in cropping pattern we may use Diversification Index = 100 – Concentration Index. The Concentration Index (CCI) =

\[
CCI = \sqrt{\sum_{j=1}^{m} S_j^2}
\]

where \( S_j \) is the percentage share of \( j \)th crop in total cropped area and \( m \) is the total number of crops.

In this thesis empirical findings of various authors (from the early 1950’s till recent times) regarding different aspects and dimensions of agricultural production and resource use have been reviewed. The main subjects of such empirical studies are: i) resource use pattern based on marginal productivity and factor price; ii) effects of changes in prices, inputs and efficiency on farm incomes; iii) allocative efficiency and investment based transformation; iv) changes in share of purchased inputs; v) farm size and productivity; vi) effect of subsidy on efficiency of input use; vii) extent of tenancy and reverse tenancy; viii) changes in cropping pattern and cropping pattern efficiency; ix) agricultural market structure; x) efficacy of extension services; xi) role of farmer’s education; xv) determinants of farm profitability- farm size, productivity, cost control and cost effectiveness, famine, marketing etc.; xvi) contract farming.

The geographical coverage of the present study extends over the State of West Bengal in general and Nadia district in particular.

West Bengal covers (88.752 sq. Km.) 2.7 per cent of area of the country. Per capita income of West Bengal is below all India average (2003-04). The share of agriculture in State GDP was 22.32 per cent in 2002-03. The per cent of rural
population in the state (27.97 per cent) is higher than the corresponding all-India figure. The average net area sown in the State was around 5463 thousand hectares during 1994/95-2000/01. Whereas rural population has been fast growing, net cultivable area has gone down. The number of marginal farms (with holding size below 1 hectare) has increased substantially in recent years. They constituted about 60 per cent of all holdings in 1970-71. After steady increase, they constituted about 77 per cent of all holding in 1995-96 (the last Agricultural Census available). In that year the Marginal farms accounted for about 77 per cent of the number and 42 per cent of the area. The inequality in land holding has declined between 1970-71 and 1995-96. But this decline in inequality was brought mainly by substantially increasing the relative importance of the marginal farms, the most disadvantaged size class in respect of both asset holding and resource use efficiency (vide discussion in Chapter 5). The average size of holding continuously declined from 1.20 hectare in 1970-71 to 0.85 hectare in 1995-96. The average size of marginal farm is 0.48 hectare. It has been noted that for pure cultivators at least a holding size of 0.63 hectare is necessary to reach the threshold of poverty line income (Chapter 5).

West Bengal has been divided into six agro-climatic zones, viz., Hill, Terai, Old Alluvium, New Alluvium, Costal Saline and Red Laterite.

Nadia district (our focus district) is located (between 22.53° to 24.11° degrees north latitude and 88.09° to 88.48° degrees east longitude) in the New Alluvium Zone. This zone accounts for 27 per cent of area, 36 per cent of rural population (2001), 38.5 per cent of rice production (2002-03), 34 per cent of number of holdings, 32 per cent of area of holdings and 36 per cent of the marginal farmers of the state (1995-96).
This is the most fertile and productive agricultural zone of the state covering 33.26 per cent of GCA of the state. It spreads over the districts of Nadia, Murshidabad, Hooghly, 24 Parganas (North) and some parts of Burdawn. Here, very negligible cultivable area is left uncultivated. The net irrigated area was 76 per cent and cropping intensity was 170 per cent in 1995-96. This region alone has captured about 45 per cent of total irrigated area of the state as a whole. Both tubewells and canals are the main sources of irrigation. Annual rainfall within this region ranges 1350-1450 mm. Soils are deep and mostly neutral (PH 5.5 to 7.0). Land is favourable for a variety of crops. 68 per cent of its Gross Cropped Area is used for paddy production. Average size of holding of this region is lower (0.83 hectares) than the state average of 0.85 hectares in 1995-96.

The main crops of the state are rice, wheat, pulses, rapeseed and mustard, sesame, potato, jute and mesta etc. Production of vegetables of different varieties (e.g., Cauliflower, Cabbage, Tomato, Bringel, Parble, Ladies fingure and other leafy vegetables, etc.) and fruits (particularly Banana and Mango) and flower of different varieties are also important. West Bengal accounted for output 71.7 per cent of jute & mesta, 34.7 per cent of potato, 15.6 per cent of sesame and 14.6 per cent of rice in 2000-01.

Nadia is one of the most important agriculturally developed districts in West Bengal situated not very far away from the state capital Kolkata, covering a total area of 3927 sq. km. (of which 3716.83 sq. km. is rural) and it accounts for 4.42 per cent of state area with 5.74 per cent of state population (4604827 population as per 2001 census) and is the 5th highest densely populated district in the state.

This district totally belongs to the most fertile agricultural productive zone (i.e., Zone IV, New Alluvium Zone) of West Bengal. The soil of the district is alluvial
and area suitable for a large variety of crops. Annual rainfall for the year 2002 was 1375 m.m.; maximum air temperature 43° C and minimum 10° C which varies substantially from year to year (Handbook, Nadia 2003).

Per capita net district domestic product (NDDP) at constant (1993-94) price for Nadia is Rs. 9843.32 in 2000-01 which is above the state average of Rs. 9764.75 and the contribution of agriculture in NDDP of Nadia is 35.6 per cent.

Land utilization statistics for Nadia show that net cropped area, area of forest, area of misc. tree crops and groves declined during 1980-81 to 2000-01, whereas land put to non-agricultural uses increased from 52.54 thousand hectare to 75.93 hectare (about 44.5 per cent change) during the same period. For the same period, land put to non-agricultural uses in West Bengal increased about 20.3 per cent.

Tubewells are the main source of irrigation (about 96 per cent of irrigated area) in the district.

In Nadia in 1995-96 marginal farms accounted for 71.37 per cent of the number of holdings and 47.31 per cent of the area of holdings.

Cropping intensity was 242 in 2000-01 in the district against in state figure of 168.

Nadia contributed a significant percentage in total production of aus, boro, wheat, rapeseed & mustard, jute and pulses in West Bengal. In fact, whereas in 2002-03 Nadia accounted for 5.8 per cent of Net Cropped Area of west Bengal, its output contribution is much more higher in respect of pulses (31.57 per cent), Rapeseed & Mustard (23.38 per cent), Jute (22.64 per cent), Aus(14.90 per cent), Wheat (14.29 per cent), and Boro (13.17 per cent).
Nadia has been divided into 17 Blocks. A block is generally considered the unit of rural planning.

The present study is based on both secondary and primary data. The collected data have been subjected to various statistical and econometric techniques for the purpose of our study. A brief description of our secondary data base is given below. Chapter 7 is concerned with discussion on primary data collected through sample survey.

Farm level secondary data are collected from two sources as shown in the following Table

<table>
<thead>
<tr>
<th>Crops</th>
<th>Year</th>
<th>Sample size</th>
<th>Area</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>PADDY</td>
<td>1989-90</td>
<td>71</td>
<td>Zone IV: (New alluvium zone of West Bengal covering Nadia, Murshidabad, Hooghly, 24 Parganas(N) and some parts of Burdwan)</td>
<td>Comprehensive Scheme of Cost of Cultivation, 1989-90, G.O.I</td>
</tr>
<tr>
<td>BORO  (HYV)</td>
<td>2000-01</td>
<td>37 (standard* farms out of total 467 farms)</td>
<td>12 Districts (such as Jalpaiguri, Coochbehar, Dinajpur, Malda, Murshidabad, Nadia, 24 Parganas, Howrah, Burdwan, Birbhum, Bankura, Midnapur.</td>
<td>Farm Management Study, 2000-01, Govt. of West Bengal.</td>
</tr>
<tr>
<td>AMAN  (HYV)</td>
<td>2000-01</td>
<td>36 (standard* farms out of total 467 farms)</td>
<td>11 Districts (such as Jalpaiguri, Coochbehar, Dinajpur, Malda, Murshidabad, 24 Parganas, Howrah, Burdwan, Bankura, Purulia, Midnapur.</td>
<td>Farm Management Study, 2000-01, Govt. of West Bengal.</td>
</tr>
<tr>
<td>POTATO</td>
<td>2000-01</td>
<td>20 (standard* farms out of total 121 farms)</td>
<td>6 Districts (such as Jalpaiguri, Murshidabad, Howrah, Bankura, Purulia, Midnapur)</td>
<td>Farm Management Study, 2000-01, Govt. of West Bengal.</td>
</tr>
</tbody>
</table>

Note: *The standard farm for each size group in a district refers to the average of all sample farms under the reference group in each sample district. Thus, e.g., when Boro (HYV) we have relevant data for 12 districts in respect of marginal farmers the total number of standard farms in this size group comes to 12.
Data has been analysed to measure efficiency and identify some relevant factors in this regard. The following methods (discussed in Chapter 2) have been particularly used: Data Envelopment Analysis (DEA), Stochastic Frontier Production Analysis (SFA) and Analysis of Unit Cost (AUC) to measure Technical Efficiency (DEA & SFA), Allocative Efficiency (DEA), Cost Efficiency (DEA & AUC). The techniques of multiple regression in respect of various relevant variables (subject or dependent variables and explanatory or independent variables) have also been used. Correlation coefficients related to some relevant variables have also been estimated to ascertain the mutual relation between them. An index of Concentration/Diversification (discussed in Chapter 2) is used to measure crop diversifications and to measure concentration of land holding in terms of number and area of holdings. Inequality in the structure of land holding is also measured by Gini-coefficient.

The following relations/hypotheses have been particularly examined on the basis of data considered:

1. Total output of a crop depends on land area, labour and fertiliser inputs and for that matter yield rate (output per hectare) depends on labour use and fertiliser consumption per hectare.

Estimated stochastic frontier production function based on data related to paddy of all varieties in 71 farms spread over New Alluvium zone of West Bengal (Zone IV) revealed the fact that total output of paddy depends significantly on area, labour use and fertiliser consumption (pp.128).

In case of Boro (HYV) paddy (37 farms) on application of frontier methodology we have also found that yield rate of Boro (HYV) paddy per acre significantly depends on rate of labour use per acre and rate of fertiliser consumption per acre (pp. 129).
2. Value of output per hectare depends on Crop Yield Index (CYI), System Index (SI) and Cropping Intensity (CI).

The estimated linear multiple regression equation based on block level data related to 7 important crops accounting for more than 85 per cent of total cropped area of Nadia district, shows that variations in value of output per hectare is explained by the variations in CYI, SI and CI. All these explanatory variables significantly and positively promote value of output per hectare (pp. 186).

3. Agricultural income per hectare depends on cropping intensity and rate of fertiliser use.

It appears from the estimated regression equation by Maximum Likelihood Estimation (MLE) (frontier approach) method that the inter-district variation in agricultural income per hectare is significantly and positively influenced by cropping intensity (CI) and fertiliser consumption per hectare (pp. 176).

4. Cost Efficiency depends on Land Area, Proportion of family labour to total labour, percentage share of cost of fertiliser in total cost of production.

Multiple regression results based on relevant data of 71 farms for all paddy show that the percentage share of cost of fertiliser in total cost has negative impact on cost efficiency whereas percentage share of family labour in total labour use and farm size (in terms of land area) positively influence cost efficiency of sample farms though not so highly significant. The fact is also corroborated by regression results obtained in case of Boro (HYV) paddy (37 farms). With the use of dummy variable in regression model we have found that the cost efficiency for big farm holding land 4 hectare and above is significantly higher than other groups of farms (pp. 133).
5. Unit cost depends on yield rate, average wage rate, percentage of family labour to total labour and percentage of paid-out cost to total cost.

The analysis of regression results relating to the determinants of unit cost of production in Aman (HYV) paddy in 36 farms reveals that unit cost significantly depends on yield rate, average wage rate, percentage of family labour to total labour and percentage of paid-out cost to total cost. Increase in yield rate may reduce unit cost but average wage rate, share of family labour in total labour and share of paid-out cost in total cost increase unit cost of production (pp. 148).

6. Unit cost of production depends on yield rate, farm size and fertiliser use per hectare.

Based on analysis of primary data on Boro (HYV) paddy of 83 farms estimated linear multiple regression equation shows that unit cost of production depends positively on rate of fertiliser use per hectare and inversely on yield rate and farm size (pp. 217).

7. Profit over Total Cost/Paid-out Cost per hectare depends on price of output, unit cost of production and percentage share of fertiliser cost in total cost.

In case of Aman (HYV) paddy production based on 36 farms we have found that both profit over total cost and profit over paid-out cost depend significantly on price of output (positively), unit cost of production (negatively) and percentage share of fertiliser cost in total cost (negatively) (pp. 148).

8. Productivity, Cost and profit per hectare vary with farm size.

From a tabular analysis of aggregated data related to Aman (HYV) crop it is observed that medium farms (holding land 2-4 hectare) have performed best in respect of output per acre, labour productivity, output per rupee of non-labour cost, profit over total cost, profit over paid-out cost and unit profit (price -average cost). Unit cost
of production is found to be lowest for them. Marginal farms (below 1 hectare) are
observed to be reporting highest unit cost and lowest profit over total cost.

In case of potato there is clearly inverse relationship in physical output per
acre and farm size but in terms of value of output per acre marginal farms are at the
bottom. The analysis of both the crops (Aman (HYV) and Potato) suggest that on the
whole marginal farmers are least advantaged size class and medium farmers are most
advantaged size class (pp.142).

9. Efficiency score varies with farm size.

Estimates of different types of efficiency (viz., Technical Efficiency (TE),
Allocative Efficiency (AE) and Cost Efficiency (CE)) scores by frontier methodology
across farm size show that technical efficiency varies positively with farm size in
Boro (HYV) (37 farms) and potato (20 farms) production in 2000-01. There is
systematic relation between mean AE scores and farm size only in case of Boro
(HYV) paddy in which it is observed to have positive relation (pp. 131).

10. In the present stage of resource use marginal productivities of land, labour
and fertiliser are diminishing.

Analysis of marginal productivity of land, labour and fertiliser with the help of
curve estimation on paddy production of 71 farms clearly indicates that the marginal
physical productivities all these of factors diminish significantly it. Further, the
decline of marginal product of fertiliser is much sharper compared to those of land
and labour (pp. 155).

11. Farmer uses inputs with full regard to the equality between marginal
productivity and factor price.

Based on data related to 71 farms in all varieties of paddy and 37 farms in Boro
(HYV) paddy t-test results revealed overall rational use of labour input in Boro
(HYV) production in West Bengal during 2000-01 and excess use of it during 1989-90 in case of all paddy production (pp. 158).

12. Family labour as percentage of total labour varies inversely with farm size.

Analysis of input structure shows that the percentage share of family labour in total labour used in Aman (HYV) and potato production during 2000-01 decreased monotonically as farm size increased (pp. 145).

13. Paid-out cost as percentage of total cost varies directly with farm size.

Analysis of cost structure in case of Aman (HYV) and potato production shows that the relationship between farm size and percentage share of paid-out cost in total cost is not unique but it is found that paid-out cost as percentage of total cost is highest for big farms in both these crops and lowest for marginal farms in Aman (HYV) crop (pp. 143).

14. Output price varies inversely with farm size.

It is observed the aggregated data related to Aman (HYV) and potato that there is a unique and positive relation between price of output and farm size (pp. 140).

15. Percentage share of marginal farmers depends on rural population density per square kilometre, percentage share of non-agricultural income in State Domestic Product, proportion of landless labourers who have become Patta-holders (an important type of beneficiary of Land Reforms).

Estimated log-linear multiple regression equation based on district level data revealed that the percentage share of marginal farmers in total number of holdings depends on rural population density, percentage share of non-agricultural income and number of patta holders as percentage of existing landless agricultural labourer. All these explanatory variables significantly increase number of marginal farmers (pp. 191).
16. Rate of labour use per hectare is greater in HYV crops than local varieties.

Farm management study data revealed the fact that rate of labour use per hectare is greater in Aman (HYV) than in Aman (Local) (pp. 196).

17. Labour use in agriculture depends on cropping intensity, percentage share of marginal farms in total area of holdings, cropping pattern, labour productivity and wage rate.

It is observed from the regression results that the rate of labour use per hectare of Net Cropped Area has been significantly and positively dependent on (i) intensity of multiple cropping (CI), (ii) labour intensiveness of the cropping pattern (CP), (iii) percentage of area under marginal farms (MFA), and (iv) labour productivity (LP) and negatively dependent on (v) average wage rate (WR) (pp. 200).

18. Unemployment in agriculture depends negatively on land productivity, labour productivity, relative labour productivity in agriculture, irrigation facilities and rural infrastructural facilities and positively on agricultural wage rate.

Correlation coefficient estimates based on district level data revealed the fact that rate of unemployment of agricultural workers in agriculture is negatively and significantly associated with land productivity, labour productivity, relative labour productivity in agriculture, irrigation facilities and rural infrastructural facilities but positively with average wage rate. Multiple regression results on unemployment rate in agriculture also show that cropping pattern in favour of labour intensive crops, labour productivity and average wage rate significantly explained the variations in unemployment rate (pp. 206).
Regarding sample survey for collection of primary data it may be noted that the broad location has been selected purposively on the basis of following considerations: typical area from the point of view of the cropping pattern, accessibility and assurance of cooperation from the farmers. But the study village has been selected at random. The sample households have been selected by method of stratified random sampling. The characteristics of sample farms (numbering 112) have been examined. Since Boro paddy was overwhelmingly the most important crop, it has been singled out for computation of Efficiency Score by AUC method. Other relevant variables like Value of Output per Man Day, Percentage of Family Labour to Total Labour, Fertiliser Consumption per acre, Paid out cost per quintal output, Price of Main Product, Net Farm Business Income per acre, Farm Size, No. of Fragmentation per acre, Asset value other than Land, Family Size and Age of Decision Making Farmers have also been analysed. The factors having influence on the unit cost of production have been examined by means of multiple regression analysis. The results show that the unit cost of Boro paddy is negatively related to the yield rate and the farm size but positively related to the rate of fertiliser use. Thus it has been found that higher yield rate has tended to reduce unit cost, larger farms have been able to produce the crop at lower unit cost; but increase in the rate of fertiliser use has tended to increase unit cost signifying that the lower productivity of fertiliser has not been adequately compensated even by subsidised fertiliser price. It is quite possible that in the absence of any soil testing there has been over use of fertiliser.

Some observations on the nature of land reforms in West Bengal and some suggestions regarding the rate of labour use in rural West Bengal (discussed in earlier Chapters) may be highlighted here.
Land reforms is sometimes considered as a very important factor in the changes in West Bengal’s agriculture scenario in course of last few decades.

The impact of land reforms may be evaluated in terms of the following factors:

(i) change in the land use pattern
(ii) change in respect of inequality in the land holding structure
(iii) change in the class character of the farmers
(iv) change in the average size of farms
(v) change in the number of landless labourers

There has been considerable reduction in net cropped area (e.g., more than 90,000 hectares) between 1980-81 and 2000-01.

Inequality in the structure of land holding (measured by Gini coefficient relating to number and area in different size classes) has declined, slowly initially from 0.48 in 1970-71 to 0.46 in 1976-77 to 0.46 (unchanged) in 1980-81; but the pace of reduction accelerated thereafter; Gini coefficient declined to 0.41 in 1990-91 to 0.37 in 1995-96 (latest year of Agricultural Census).

But this decline in inequality was brought mainly by substantially increasing the relative importance of the marginal farmers, the most disadvantaged size class in respect of both asset holding and resource use efficiency (vide discussion in Chapter 5).

The average size of holding continuously declined from 1.20 in 1970-71 to 0.85 in 1995-96. The average size of marginal farms was only 0.48 in 1995-96. It has been noted that at least a holding size of 0.63 hectare is necessary to reach the threshold of poverty line income (Chapter 5).
It has been further noted that the number of landless labourers increased from 3.9 million in 1980-81 to 7.4 million in 2000-01 putting a question mark on the efficacy of the slogan of land to the tillers.

Increase in the well being of the farming community seems to require that the number of marginal farmers be reduced mainly by absorbing a substantial portion of them in more remunerative non-agricultural occupations, to be promoted not by taking away productive agricultural land but by developing agro-based industries and production of mass consumption goods by the mass. Redistribution of land taken away from more-advanced size class to less-advanced size class may not change the basic character of the less-advantaged class but may only make progressive agriculture more difficult. Inequality in land holding may be better reduced not by giving some more land to the marginal farmers without reducing their number but by remuneratively absorbing them in lucrative non-agricultural activities. A progressive land reform programme should have a dynamic and progressive perspective and not a regressive one aiming at increasing the preponderance of the least-advantaged class.

For increase in the scope of generation of gainful employment opportunities in the rural sector in general and agricultural in particular the following suggestions may be considered.

1. Increase in cropping intensity without adversely affecting conservation of land fertility

2. Change in cropping pattern in favour of such crops in which labour requirement per hectare is relatively high without adversely affecting food security.
3. Increase in activities relating to processing of crops, particularly food processing, in a labour intensive manner in the vicinity of rural areas ensuring absorption of unemployed and underemployed rural labour force.

4. Linking of agricultural wage rates with labour productivity.

5. Expansion and improvement of irrigation facilities.

6. Strict regulation of growth of non-agricultural activities by way of shifting land away from agriculture without commensurately absorbing surplus agricultural labour in non-agricultural activities but gainful shifting of labour away from agriculture by development of agro-based industries and production of mass consumption goods by the mass.

7. Sustained growth of agricultural output will make possible stable rate of labour absorption. Agricultural research may be directed towards evolving an alternative technology capable of ensuring sustained growth of agricultural output in view of the tapering off of the yield-increasing capability of the present environment-inimical chemical technology. Further, whereas chemical technology is dependent on centralized production of chemical fertiliser and insecticides, organic farming, to be developed as an alternative to chemical farming, will make possible decentralised production of plant nutrients and plant protection materials which will create substantial increase in rural employment through backward linkage (i.e., input provision).