CHAPTER II

REVIEW OF LITERATURE
CHAPTER II

REVIEW OF LITERATURE

The reviews of past works enable us to have a clear picture of what has been done in the particular field in the recent past, thus avoiding duplication of work. They also report the major findings of some of the related studies undertaken in India and other countries, using similar methodology. However, although the techniques applied may be almost the same, the results may differ due to the diversity within or between regions, their institutional environment, period of study, data base, specification of variables and the choice of different combinations of variables. Further, direction of enquiry of each study may be different depending on the importance of specific problems and data availability. Nevertheless, a brief review of related literature would be of great methodological interest. It would serve to illustrate a varying range of policy alternatives, which have vital importance for resource use in agricultural development.

Voluminous literatures are available on each of these subjects. Since it is too ambitious to include all of them in this chapter, only a few important related works are reviewed here. For better exposition, the review of literature has been organized under the following headings:
(i) Cost and Return

(ii) Resource productivity – Resource-use Efficiency – Production function approach.

(iii) Studies on yield gap.

2.1 COST AND RETURNS

2.1.1 Cost:

The relationship between cost and return is of crucial importance in agriculture. Cost of cultivation is an important determinant of price.

The nature of cost incurred by a farmer is of two kinds – (a) variable or operational cost and (b) fixed cost.

The performance of crop enterprise and its progress can be estimated by finding the relationship between the costs incurred and the returns accruing from the crop production. However various methodological issues arises frequently in estimation of costs and returns on account of variation in farms and production structures between lands of same region. Hence, clear cut definitions of costs and returns are necessary for realistic estimation.

Costs in farming are classified into fixed and variable costs. Fixed costs represent farming expenses of an overhead nature and they do not change with output. They also include taxes, depreciation, cash rent and interest payments,
variable costs refer to the farming expenses which change with the output. “Fixed costs relate to the variable resources.”

According to Madappa, cost of production has been divided into three main categories namely (i) cost of cultivation, (ii) cost of preparing the produce for the market and (iii) miscellaneous costs.

Bradford and Johnson categories farm expenses into four types (i) the items which are solely used within the year i.e., current expenses, (ii) depreciation of properties, (iii) decreases in inventories and (iv) uses of labour services performed by the members of the family other than the farm operation.

According to Kahlon, fixed cost includes depreciation on the value of capital assets interest on the value of capital investment. An additional item of rent paid (or) payable is also taken into account.

---


Kapore\textsuperscript{5} gives the cost concepts as follows:

\textbf{Cost A1} : Value of hired human labour + value of hired and owned bullock labour + value of hired and owned machine labour + value of owned and purchased manure + irrigation charges + land revenue, cess and other taxes + interest on working capital + miscellaneous.


\textbf{Cost B} : Cost A2 + Imputed rental value of owned land (less land revenue paid) + Imputed interest on owned fixed capital (excluding land).

\textbf{Cost C} : Cost B + Imputed value of family labour, Varma\textsuperscript{6} gives the cost of production consists of the sum total of the various values (Prices times the quantity used) that must be paid for the various goods and services employed in the production of a commodity. This is divided into:

\textsuperscript{5} B.N. Kapore, "Comprehensive Scheme for Studying the cost of cultivation of Principal crops", \textit{Agricultural Situation in India}, Vol.29, No.5, 1974, p326.
Cost A1: All cash and kind expenses minus rent, i.e. wages of hired human labour, value of bullock labour (hired and owned) seeds and manures, pesticides, fertilizers, (farm produced and purchased) irrigation charges, interest paid in cash and depreciation on implements.


Cost B: Cost A2 + Interest on owned and borrowed capital.

Cost C: Cost B + Imputed value of family labour.  

The Farm Management Studies in India broadly classified cost of cultivation into (i) Cost A, (ii) Cost A2, (iii) Cost B and (iv) Cost C. The following are the item included under each of them.

1. Cost A1

(a) Value of hired labour (permanent and casual)
(b) Value of owned hired bullock labour
(c) Value of hired bullock labour
(d) Value of owned machinery
(e) Hired machinery charges


(f) Value of fertilizers

(g) Value of manure (owned and purchased)

(h) Value of seed (both farm produced and purchased)

(i) Value of insecticides and pesticides

(i) Irrigation charges (both owned and hired machines)

(k) Canal water charges

(l) Land revenue, cesses and other taxes

(m) Depreciation on farm implements (both bullock drawn and used by human labour)

(n) Depreciation on farm buildings, farm machinery and irrigation structure

(o) Interests on working capital and

(p) Miscellaneous expenses (artisans, ropes and repairs to small farm implements).

2. **Cost A2:** It includes Cost A1 and

(q) Rent paid for leased in land.

3. **Cost B:** It includes Cost A2 and

(r) Imputed rental value of owned land (less land revenue paid there upon) and

(s) Imputed interest on fixed capital (excluding land).

4. **Cost C:** It includes Cost B and

(t) Imputed value of family labour.
Cost A1 is incurred by a farmer when he is the owner and contributes his own land and other resources. Cost A2 is the tenant cost incurred by him when all the land is leased-in and rent has to be paid for it. Cost B is incurred when, in addition to the above costs, imputed interest is paid on owned fixed capital. Cost C is incurred when the imputed cost of family labour is also included. It is the most comprehensive cost.

In their study on the cost and returns of principal crops in the districts of Tamil Nadu, Rajagoplan et al.,\(^8\) considered only Cost A (variable) and Cost C (fixed). The two concepts included the following components.

1. **Cost A:**
   
   (i) Value of human labour, including family labour
   
   (ii) Value of bullock labour
   
   (iii) Value of machinery charges
   
   (iv) Value of seed
   
   (v) Value of insecticides
   
   (vi) Value of manures and fertilizers
   
   (vii) Cost of irrigation and
   
   (viii) Interest on working capital.

---

\(^8\)V.Rajagopalan, et al., *Studies on Cost of Production of Major Crops in Tamil Nadu*, Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore. 1978, pp.2-3.
2. **Cost C:**

Cost A plus rent (including rent paid by the tenant or rental value of owned land) + interest on fixed capital, excluding land + land revenue, cesses and taxes + depreciation of implements and machinery. Cost C was computed from Cost A, assuming that the latter accounts for 70 per cent of the total cost. This is a highly arbitrary assumption.

In the present study, Cost A (variable cost) and Cost C (fixed cost) are considered for the analysis of the cost structure of both banana and paddy cultivation. The two categories of cost include the following items.

1. **Cost A**

   (i) Human labour including family labour
   (ii) Bullock labour
   (iii) Chemical fertilizers
   (iv) Pesticides
   (v) Seeds cost (cost of suckers)
   (vi) Farm manures
   (vii) Cost of irrigation
   (viii) Plant protection measures and
   (ix) Interest on working capital

2. **Cost C (Cost A plus)**

   (x) Rent and
   (xi) Interest on fixed capital excluding land, land revenue, cess and taxes and depreciation of implements and machinery.
2.1.2 Returns:

Gross income is the income from the crops grown. The values of both main products (s) and by product (s) are added together in estimating the gross income.

Singh defines output as the sum of the gross value of output (main plus by product) of all crops evaluated at harvest prices in the reference year irrespective of whether it is being consumed or sold or maintained in the stock, less the value of seed.

According to Tandon and Dhondyal gross income includes (i) cash received on account of the sale of farm produce, (ii) value of the produce main (or) by products used for home consumption and for cattle feed or given as wages in kind and (iii) value of seed stored for sowing purposes.

---


Kaul and Mehta define gross farm income as the value of farm produce that consists of cash value of the produce evaluated at the harvest prices prevalent in the village.  

According to Sukumar the gross income farm crops produce include the value of retained as well as market crop output at prevailing price. Shukla and Misra define net income as the gross income minus total cost.  

Miglani defines net income as gross income minus cost and included in the cost are expenditure on seeds, manures, fertilizers, pesticides, human labour, bullock labour owned and hired, running expenditures and depreciation, irrigation structures, farm machinery, implements and buildings, interest on working capital.  

In the present study, gross income includes both main and by-product of a crop. Net income or return is measured by subtracting Cost C from gross income.

---


2.2 RESOURCE PRODUCTIVITY, RESOURCE-USE EFFICIENCY – PRODUCTION FUNCTION APPROACH

Efficiency of firms can be measured in a number of ways. The problem of resource allocation and its administration in the farm business will have to consider, the physical (technical) economic and institutional factors. The major lines of approach or methods available in farm management analysis are viz.,

1. Factors affecting farm profits
2. The general production function
3. The budget approach (Shaw and Wright, 1955).

The production of individual resources can be derived from the production function, which indicates efficiencies of individual resources when used in varying quantities and proportions.

The application of the production function concept in farm management analysis is a new development and the importance of production functions for policy recommendations have been recognized in the recent past.

In the field of industries Cobb-Douglas (1928) developed an exponential type of production function for American manufacturing industries over the period of 1899-1922.

The general form of the equation in \( Y = Zx \), where \( x \) represents the variable resource measured. \( Y \) represents the output and \( Z \) the transformation ratio of the \( x \) at different magnitudes.
This equation can be converted into linear form by using logarithms and can be written as

\[ \log Y = \log a - \log x. \]

Recently the Cobb-Douglas type of production function has found the widest application in the field of agriculture. Several crop production functions have been derived for estimation of the resource efficiency. The studies of Tintner (1944)\textsuperscript{16}, Brownlee and Tintner (1944)\textsuperscript{17}, Heady (1946)\textsuperscript{18}, Battagacharee (1955)\textsuperscript{19}


\textsuperscript{17}O.H Brownlee and G. Tintner, "Production Functions Derived from Farm Records", \textit{Journal of Farm Economics}, Vol. 26, 1944, pp.566-571.


Olson (1959) etc. are a few in this field.

In India the first production function study was undertaken by Singh (1941) and Panse (1951) who fitted quadratic functions to estimate optimum dose of nitrogen for production of paddy and cotton. The different farm management studies conducted by the Directorate of Economics and Statistics adopted the Cobb-Douglas type of production function for different crop enterprises and livestock enterprises.

---


Shastri (1958)\textsuperscript{25}, Suryanarayana (1958)\textsuperscript{26}, Dhondyal (1958)\textsuperscript{27}, Agarwal and Forman (1959)\textsuperscript{28}, Randhawa (1960)\textsuperscript{29}, Das Gupta (1961)\textsuperscript{30} and Rao (1964)\textsuperscript{31} have used the production function in their different studies.

For the evaluation of the efficiency of resources used the aggregate production functions for the farm as a whole were worked out by different economists.

Singh (1940) fitted the whole farm production, for a cost accounting study with size of holding, intensity of cropping, wheat yield, mandays and bullock days as variables.\textsuperscript{32}


\textsuperscript{29} N.S. Randhawa, “Returns to Scale and Co-operative Farming”, \textit{Indian Journal of Agricultural Economics}, Vol. 15, No.3, 1960, pp.22-33.


\textsuperscript{32} A.Singh, \textit{op.cit.} p. 85-93
Suryanarayana (1958) worked out the whole farm production functions to estimate the resource return in Telengana farms with separate functions for wet, dry and mixed types of farm and single function for the combined holdings of all types.\textsuperscript{33}

Jeyaprakash (1973) fitted Cobb-Douglas production function model taking the total yield in kilograms as dependent variable. The independent variables like land value, manures, plant protection chemicals and irrigation charges were valued in rupees. Human and bullock labour were valued in mandays and pour days respectively.\textsuperscript{34}

Rana and Others (1978) studied apple production in Kumarsain block of Simla district. The variables considered in the analysis were quantity of labour, fertilizers, organic manures, total value of pesticides used per acre, the age of the apple grove in years and a disturbance term(s) independently distributed with zero means and finite variance.\textsuperscript{35}


\textsuperscript{34} S. Jeyaprakash, "A Study on the Production and Marketing of Chillies in Oddanchatram Block, Madurai District, Tamil Nadu", (Unpublished M.Sc. (Ag.), dissertation submitted to Tamil Nadu Agricultural University, Coimbatore, 1973, p.36.

Jeyaraman (1981) studied the magnitude of the influence of the independent variables over the dependent variable. He fitted a linear type production function with five independent variables, namely, age of the plantation, cost of manures and fertilizers, cost of pesticides, total establishment cost in rupees up to earning stage and total human labour used in mandays. The total yield in kilograms per hectare was taken as the dependent variable.\(^3^6\)

In their study of rubber plantations, Batoctoy and Others (1982) fitted a simple linear regression model with yield per hectare per month as the dependent variable. The tappable area, tappable trees per hectare, age of the tree when tapped, labour cost, cost of chemical fertilizers and educational attainments of human labour employed were taken as independent variables.\(^3^7\)

Rajkrishna (1964) has fitted up whole farm production functions with different input variables to study their efficiencies.\(^3^8\)


Acharya (1967) while discussing the methodological considerations, in fitting the Cobb-Douglas production function listed out the advantages of the Cobb-Douglas function as follows:

Its use involves relatively simple computation fitting in well with the time and resources available.

The function has given immediately, through the regression co-efficients, elasticities of production of the individual factors and these elasticities are independent of the unit of measurement.

The function permits automatically the phenomenon of diminishing marginal productivity of each factor input and causes the productivity of one resource to be dependent on the magnitude of the other, without too many degrees of freedom.

It is assumed that the errors in the data are small and the normally distributed a logarithmic transformation of the variables will preserve the normality to a great degree in the distribution of errors in the data.

The function does not have a restriction to the assumption regarding returns to scale, which may be decreasing or constant or increasing as measured by the sum of elasticities of factors input.

Hypothesis about the size of the individual elasticities may be easily tested.

The function can be easily manipulated so that marginal productivity estimates of the factors may be easily obtained.
As various researchers have indicated in the past, after fitting their data to the Cobb-Douglas function, though the various limitations of the function, the latter works in practice.\(^{39}\)

Saini\(^{40}\) in his study has estimated Cobb-Douglas type production function by the method of least squares to evaluate the efficiency of farmers in Northwestern India. His study is based on disaggregate farm level data obtained from Meerut and Muzaffarnagar in Uttar Pradesh and Amristsar and Ferozepore in Punjab for the years 1955-56 and 1956-57. The main findings of his study are:

1. There is inverse relationship between farm size and productivity in Indian Agriculture.
2. Indian agriculture is operating under constant returns to scale.
3. At the marginal productivity of each input equal to its acquisition cost, Indian farmers were very rational in the use of their resources.

Peter in his study on “Input-output Relationship of banana plantations in Kanyakumari district” fitted a Cobb-Douglas type production function to estimate the productivity of various inputs used in the banana plantations. He proved that

---


there was a highly significant positive response in gross income to the positive changes in the manuring expenses.\footnote{D Peter, "Input-output Relationship of Banana Plantations in Kanyakumari District (Tamil Nadu)", \textit{Indian Journal of Agricultural Economics}, Vol.29(2), 1974, pp.59-65.}

Gangwar and Singh\footnote{A.C. Gangwar and J. Singh, "Production Functions for Commercial Crops in Haryana", \textit{Indian Journal of Agricultural Economics}, Vol. 29(3), 1974, pp.143-144.} have examined the marginal value productivities of the farm sector of Haryana for different crops, namely cotton, mustard, sugarcane and oil seed. In order to estimate the marginal value productivities of inputs used in different crops Cobb-Douglas production type was used. They collected primary data for their analysis. They found from the results of the analysis the following

1. The use of fertilizer, irrigation and human labour explained about 87, 72 and 59 per cent of the variation in the production of sugarcane, cotton and mustard respectively.

2. The marginal value productivity of fertilizer and irrigation for sugarcane were less than unity.

3. Cotton was a more profitable crop than the sugarcane and mustard in Haryana.
Prasun Kumar Chattopadhyay and Saini\textsuperscript{43} have studied the relative productive efficiency of inputs in paddy cultivation in West Bengal. The main aim of the study was to examine the extent of yield per acre and the income of paddy for different inputs. For this, Cobb-Douglas production function type was fitted by using primary data. The major findings of the study were:

1. Marginal value productivity of human labour was generally less than its factor cost, whereas for fertilizer, irrigation and capital, it was generally greater than its factor cost.

2. In order of the efficiency of different inputs, capital stood first, irrigation second, fertilizer third and human labour fourth.

Syam Sundar and Gowda\textsuperscript{44} in their study on "Resource Productivity and Allocation Efficiency of Irrigated Onion" opined that the resources that significantly explained the variations in the productivity of onion in Chickballapur taluk were area under crop (0.426) and human labour (0.258). Productivity of small farmers was significantly affected by human labour (0.667) and plant protection chemicals (0.359).

\textsuperscript{43} Prasun Kumar Chattopadhyay and K. Saini, "Relative Productive Efficiency of Inputs in Production of Paddy in 24 Parganas District - West Bengal", \textit{Agricultural Situation in India}, Vol.32(1), 1977, pp.7-8.

Olekar et al.\textsuperscript{45} found the variables included in Cobb-Douglas type of production function were able to explain the variations in yield of sunflower to the extent of 91 per cent and 86 per cent of small and large farms respectively. The output elasticities of human labour, bullock labour and farm yard manure were found to be significant indicating that there was scope to increase sunflower production further by increased use of these inputs.

Venkataramana and Gowda\textsuperscript{46} in their study on productivity and resource-use efficiency in Tomato cultivation found that regression coefficients of land area under the crop (0.2881) and staking material (0.2076) were significant at 5 per cent level. In case of large farmers, the coefficients of fertilizer (0.3010), human labour (0.5135) and animal labour (0.1419) were significant at 5 per cent. The sum of elasticities were 1.0434 and 1.0712 for small and large farmers respectively. The ratio between marginal value product to factor cost and factor cost was used as a measure of resource-use efficiency. The output could be increased by increasing the area of land in the case of small farmers but there was no scope for additional area under tomato production for the large farmers.


In the present study, Cobb-Douglas type of production function is to be fitted to analyse and compare the resource productivity and resource-use efficiency of banana and paddy in Thoothukudi district. Hence, the present study is an addition to the existing literature in which an attempt was made to empirically estimate the efficiency of the resource use in the banana and paddy cultivation.

2.3 YIELD GAP

Agricultural research centres strive to maximise yield through optimum use of resources. These centres seek to develop technologies suitable to the socio-economic conditions of a region, through integrated socio-economic and biological research. Generally the yield gap is referred to as the difference between the experiment station yield and actual farm yield.\(^\text{47}\)

There are two common ways in which the concept of yield gap can be defined. First, directly comparing the experiment station yield to the yield at farm, second comparing yield of the best farm with that of the average farm.\(^\text{48}\) Thus the yield gap can be grouped into two types, that is, yield gap I and yield gap II. The


yield gap I explains the difference between experiment station yield and potential farm yield. The yield gap II represents the difference between potential farm yield and actual farm yield.

The maximum yield obtainable from a variety under a particular situation is called ‘potential yield’ while the average yield attained under farm condition is known as the ‘actual yield’. The factors that prevent farmers from achieving the potential yield under farmers’ conditions are known as ‘yield constraints’.

There are three types of constraints which cause yield gap. They are

1. Environmental constraints
2. Biological constraints
3. Socio-economic constraints

Environmental constraints are caused by (i) environmental differences and (ii) non-transferable technology. These constraints are responsible for yield gap I

Biological Constraints include

(i) Poor nursery management
(ii) Poor fertilizer management
(iii) Poor irrigation management
(iv) Disease and pest

*Kwanchi A. Gomez, *op.cit.*, pp.1-16.*
(v) Poor ratoon management
(vi) Poor seed management
(vii) Problem soil.

Socio-economic constraints arise from

(i) Cost and returns
(ii) Credit
(iii) Input and supply
(iv) Price policy
(v) Institutions
(vi) Traditional habits

Environmental constraints are responsible for yield gap I, whereas biological constraints and socio-economic constraints are responsible for yield gap II.

Since experiment stations rarely encounter the constraints experienced by the farmers, it is not proper to consider yield gap I in a study. These estimates would be biased and larger than what it is actually under the farmers’ conditions. So, yield gap II has been examined in the study. It was defined as the difference.

---

between the highest yield obtained by the most efficient farmer in the sample and the average level of yield achieved under farmers' conditions.

Many economists have identified yield gap in different ways.

Davidson and Martin\textsuperscript{51} analyzed the yield gap for different crops, including rice in Australia. The yield gap between farms and experiment station was observed to vary according to the cultivation season. During good years, the yield at experiment station was found to increase more rapidly than the yield on farms within the same district. This was mainly because the farmers were more interested in maximizing their profits by limiting their input investment, while the experiments only aimed at maximizing yield and had no cost restraints.

Gomez developed the conceptual model of yield gap. According to him, the yield gap can be divided into two components, namely yield gap I and yield gap II. Yield gap I corresponds to the difference between experiment station yield and potential farm yield (yield obtainable in farmers field by adopting the improved technology) and yield gap II corresponds to the difference between potential farm yield and actual farm yield. Yield gap I was hypothesized as caused by either environmental differences between experiment station and farmers field or by non-transfer of technology. Yield gap II was caused by biological and socio-economic constraints. Biological constraints referred to the

uncontrolled natural factors like soil fertility, rainfall, pest and diseases. Socio-economic constraints referred to the social and economic conditions that prevent farmers from using the recommended technology. The socio-economic constraints were the attitude and knowledge level of the farmers, cost and returns, credit institutions and input availability.52

Herdt and Wickham defined yield gap as the difference between the yield potential at experiment station during the dry season in a good year and the average national yield. They divided the gap into year to year yield variation, seasonal effects (dry and wet) water control, economic constraints, lack of availability of inputs and non-adoption of technology.53

The yield gap was taken as the difference between the potential yield (average demonstration plot yield) and the actual crop yield realized in the sample farm.54

---

52 Kwanchi A. Gomez, *op.cit.*, pp.1-16.


Gomez yield gap concept was followed by the International Crop Research Institute for semi-arid tropics for their yield gap analysis with reference to dry farming with slight modification.\textsuperscript{55}

Adulavidhaya, Bhasayavan and Others\textsuperscript{56} in Thailand in 1974-75 studied the relationship between yield and various factors like fertilizer seed control cost, land tenure and rice variety. Among all the variables, fertilizer alone was significantly related to yield.

G. Subramaniyan and Nirmala\textsuperscript{57} have defined it as yield gap II in their yield gap analysis. This is caused by biological and socio-economic constraints. Biological constraint implies the non-application of needed inputs. In another case study, Subramaniyan\textsuperscript{58} has defined it as the difference between the highest yield the farmers can get in their fields using improved technology and the actual yield obtained.


\textsuperscript{57} G. Subramaniyan and V. Nirmala, “Yield Gap Analysis in Rice Cultivation: A Case Study”, \textit{Southern Economist}, December 1, 1988, pp.15-16.

\textsuperscript{58} G. Subramaniyan, “A Study on Cost of Production, Yield Gap and Economic Efficiency in Indian Agriculture: A Case Study of Irrigated Cotton in Madurai District”. \textit{Southern Economist}, 1985, p.84.