Chapter IV

Farm Size and Productivity Relationship
CHAPTER IV

FARM SIZE AND PRODUCTIVITY RELATIONSHIP

The subject matter of this chapter is the relationship between farm size and productivity. The problem of the peasant is to fix the optimum combination of productive factors so as to get maximum output using minimum input. The productive factors in agriculture are scarce in nature. Especially, land is the more important and indispensable factor to which the other factors are to be combined. Land being a Gift of Nature, it has absolute limitations in terms of its quantity and quality.

In this juncture, this study tries to bring out the relationship between farm size and agricultural production in terms of paddy in the selected area and to analyse the relation between size of farm and profitability thereof.

It is important to explain the terms Farm Size and Farm Productivity so as to understand the relationship between the two.

Farm Size

It represents the extent of cultivated area. There is an evergoing debate regarding the measurement of farm size. The factors attributed for this is acreage, volume of input, volume of output and land revenue. Physical measurement of land in terms of acre used is the traditional and reliable method. Land surveys in most of the countries were conducted by keeping
acreage as a standard form to represent farm size. But it is criticised that this measure didn’t consider the quality difference of land.

It is also stressed by B.N. Pal that production should be measured not in terms of acre but in terms of net product per man unit. He wrote, “With the cheapening and extension of power and other external economies, the emphasis on mere area is ill-advised; it should shift to man units; Production should be measured in terms of net product per man unit (what a man can handle) and not per acre”.

The volume of inputs used in land is also suggested as a measure of size since it influences the quantum of output. The inputs may be of human and physical. Human input is always subject to quality variations as they are inherent and in-separable in nature. So, it can’t be standardised.

The physical inputs may disappear over a period of time and new inputs may emerge. And also, different combinations of these inputs may be quite possible since they are substitutable for one another. So their quantification becomes a problem. As such, this measure is not suitable for a cross-section analysis.

The volume of output has also been suggested as a measure of farm size. Output is not an independent factor. It is determined by the quality and quantity of inputs. Moreover, seasonal, environmental and natural factors
also cause fluctuations in output. So, it does not seem to be a reliable measure of farm size.

The land revenue\(^9\) fixed by the Government is also cited as a measure of farm size. Here also, there is no uniformity in fixing land revenue because of the quality variations of land. The utility value of land is not considered while fixing land revenue because the barren and uncultivable wastes also come under the purview of land revenue. So, this is also not a satisfactory factor.

The 'Farm Management Surveys'\(^10\) conducted in India and the data collected by the Ministry of Agriculture, Government of India through 'The comprehensive scheme for studying cost of cultivation' also kept acreage as a standard measure for representing farm size.

Moreover, if the land selected for the study is homogeneous in nature and if it is utilized for cultivating a single crop, acreage is the best representative of farm size.\(^11\)

Since our study covers the acres of land which are uniform in quality in terms of soil condition and we concentrate on the single crop - Paddy, we have made use of acreage as a measure for farm size.

**Farm Productivity**

Productivity refers to the quantity of output per acre.\(^12\) This measure is criticized as it gives too much importance to a single input, land.\(^13\)
But it is appropriate to accord importance to land for crops which require high land concentration. Productivity is influenced by controllable and non-controllable factors besides the quality and quantity of inputs. Productivity may be measured in terms of physical value or in monetary terms.

Quantification in terms of physical units is quite ambiguous since the quality variations in output have to be considered. As there is no specific parity among different varieties of a same product, it facilitates no comparison. There is also a debate regarding the inclusion of gross or net output. So, this measure seems to be unsatisfactory and hence this was away from common use.

The alternative method suggested is to consider the gross money value of output. The merit of this method is that it takes away the quality differences of the product. But it is criticised that the rise or fall in prices may make the value product inflated or deflated. In order to avoid this problem, values are computed for a single year and index numbers are employed to make comparisons.

The merit of this method is that it facilitates easy comparison. All inputs used in farm operations are measured in terms of money value and so the total input is computed in terms of value product. As money serves as a common measure of value, the relative efficiencies or in-efficiencies of a specific input may also easily be ascertained and the input-output relationship
can also be judged easily. So, it has become a highly satisfactory and widely recognised method for the studies pertaining to farm size and productivity relationship.

So, this study also considers the money value of the gross output of paddy and straw per unit of acre as a measure for productivity.

**A(i) Examination of Farm Size – Productivity Relationship**

Since the methods of measuring farm size and productivity have been established, the next step of determining the relationship between these two has been taken up. For this purpose, this study has classified the farms into four groups according to their tenure of cultivation. They are:

(i) Own Farms
(ii) Own Holdings
(iii) Tenant Farms
(iv) Tenant Holdings

To evaluate the comparative performance of each type of farm, the productivity, profitability, etc., of all farms have also been worked out. An Ordinary Least Square Method is employed to bring out the relationship between farm size and productivity. The function used is of the following form.

\[ \log Q = \log a + \beta \log A. \]
Where,

\[ Q = \text{Money value of gross yield.} \]

\[ A = \text{Farm size} \]

\[ \beta = \text{Efficiency parameter of A.} \]

The size and direction of \( \beta \) determine the degree of relationship between farm size and productivity. The estimated values are depicted in Table IV-1.

**Table IV-1**

<table>
<thead>
<tr>
<th>Regression No.</th>
<th>Type of Farm</th>
<th>Number</th>
<th>Constant Log ( a )</th>
<th>( \beta ) Co-efficient</th>
<th>S.E.</th>
<th>( R^2 ) (R^2)</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All farms</td>
<td>285</td>
<td>7.270</td>
<td>0.873</td>
<td>0.002</td>
<td>0.762 (0.761)</td>
<td>906.222*</td>
</tr>
<tr>
<td>2</td>
<td>Own Farms</td>
<td>130</td>
<td>7.251</td>
<td>0.861</td>
<td>0.004</td>
<td>0.742 (0.740)</td>
<td>367.949*</td>
</tr>
<tr>
<td>3</td>
<td>Own Holdings</td>
<td>45</td>
<td>5.624</td>
<td>0.949</td>
<td>0.006</td>
<td>0.901 (0.899)</td>
<td>391.012*</td>
</tr>
<tr>
<td>4</td>
<td>Tenant Farms</td>
<td>65</td>
<td>7.405</td>
<td>0.916</td>
<td>0.004</td>
<td>0.840 (0.837)</td>
<td>330.479*</td>
</tr>
<tr>
<td>5</td>
<td>Tenant Holdings</td>
<td>45</td>
<td>7.129</td>
<td>0.938</td>
<td>0.004</td>
<td>0.881 (0.878)</td>
<td>317.116*</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level.

Source: Primary Data

The table exhibits that there exists a high degree of positive relationship between the farm size and productivity. The degree of relationship between these two is closer to unity. Therefore the first hypothesis that an inverse relationship exists between farm size and productivity in the production of paddy has been disproved.
Figure IV-1

Relationship between Farm Size and Productivity

Source: Appendix Table I.
It is also observed that even though farm size influences the farm productivity positively, there is no proportionate increase in productivity. That is, if the land input increases by 100 per cent, the output of paddy increased only by 87 per cent with regard to all types of farms. So, it has been concluded that there is a tendency of increase in output in relation to the farm size.

The tenurial classification shows that the own holding and tenant holding farms are more productive than other type of farms while tenant farms are relatively less productive. So, it becomes essential to analyse the causes for the existence of positive relationship thereof and the relatively hyper productivity of own holdings.

A (ii) The Reasons for Positive Relationship

The previous studies have cited a variety of reasons for the existence of inverse relationship. Among them, the predominance of cheap family labour, intensive use of land and labour, effective supervision and management, improved irrigation, usage of better quality soil and other inputs, policy of the Government and the form of tenancy are the major causes for such a relationship.

The attempt to find the relevance of these reasons reveals a different picture. In the study area, the pre-dominance of family labour argument loses its validity now-a-days regarding farmers of own farms. Rural
non-farm employment opportunities reduce the dependency of small and medium farmers on the agricultural sector. Since they earn more income from non-farm employment, the owners of small and medium farms employ hired labour in their farms.

Further, the cheapness of family labour argument is also unacceptable. Because, the volume of family labour input used in farm operations are imputed on the basis of wage rate prevailing in the market.

Enquiry reveals that the argument of higher efficiency of family labour is also irrelevant here. The earlier farm studies related labour efficiency with the number of hours they work. But here, long hours of work make the labourers tired and exhaustive and so efficiency decreases.

Now the reason, intensity of labour use is also not suited on the ground that the labour requirement for most of the agricultural operations is replaced by mechanical power in the study area. Moreover, in modern days, there is an acute shortage of labour during busy season.

There is no empirical evidence to prove that effective supervision and management leads to increased productivity. Because, it lacks a parameter to measure the efficiency of management. Moreover, management is not a separate entity in the study area, as piece wages are offered for the agricultural operations.
Soil fertility variation based argument also lacks its validity. In the study area, there is uniformity of soil quality and hence no platform for soil fertility variations.

The results of previous empirical studies showed a differential treatment of own and tenant farms and productivity is positively associated with own farms. But the tenancy relations today are more capitalist than in earlier days. This is true in this study area also. Therefore, here tenant holdings supercede farmers of own farms in terms of productivity.

Cornia opined that small farms are characterized by a more intensive use of land and resource inputs per hectare than large farms and hence their yield is significantly higher than large farms. Availability of water is the cause for this phenomena. But, in the study area, water is available to all farmers by means of irrigation tanks and tube wells irrespective of their land size. This enables all the farms to be intensively cultivated. Hence this study area is away from the argument that small farms alone are intensively cultivated. So, there is no inverse relationship.

Since the factors cited as the causes for inverse relationship are irrelevant in the study area, it becomes essential to identify the causes for the existence of positive relationship. For this purpose, this study proceeds with the following propositions.

a) Improvement in technology adoption is a reason for positive relationship.
b) Fullest utilization of available manpower is also a reason for higher productivity of large farms.

c) Effective combination of all farm inputs facilitates the reversal of inverse relationship.

d) Capitalist relations in production and the intensified capital use have caused the breakdown of inverse relationship.

The explanations for the above propositions are given below.

a) Technology Oriented Explanations

Michael Todaro observed, “Evidence on a wide range of Third World Countries . . . clearly demonstrates that small farms are more efficient producers of most of the agricultural commodities”. But in India, the advantages enjoyed by the small farmers in the Pre-Green Revolution period were wiped out after the Green Revolution. The Green Revolution paved the way for positive relationship because of the introduction of improved technology in agriculture.

So, this study has attempted to analyse the impact of new technology on farm productivity with the help of a regression equation. For this purpose, we relate the bio-chemical input with farm size. The regression equation is 

\[ \log B = \log a + \beta \log A \]

where \( B \) = Bio-chemical input

\( A \) = Farm size; and

\( \beta \) = Efficiency parameter of \( A \).
The results are depicted in Table IV-2.

### Table IV-2

**Relationship between Farm Size and Bio-Chemical Input**

<table>
<thead>
<tr>
<th>Regression No.</th>
<th>Type of Farm</th>
<th>Number</th>
<th>Constant Log a</th>
<th>$\beta$ Co-efficient</th>
<th>S.E.</th>
<th>$R^2$ ($\overline{R^2}$)</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All farms</td>
<td>285</td>
<td>5.713</td>
<td>0.909</td>
<td>0.002</td>
<td>0.826 (0.826)</td>
<td>1347.426*</td>
</tr>
<tr>
<td>2</td>
<td>Own Farms</td>
<td>130</td>
<td>6.078</td>
<td>0.905</td>
<td>0.002</td>
<td>0.820 (0.818)</td>
<td>581.298*</td>
</tr>
<tr>
<td>3</td>
<td>Own Holdings</td>
<td>45</td>
<td>3.578</td>
<td>0.968</td>
<td>0.004</td>
<td>0.936 (0.935)</td>
<td>629.574*</td>
</tr>
<tr>
<td>4</td>
<td>Tenant Farms</td>
<td>65</td>
<td>5.744</td>
<td>0.936</td>
<td>0.003</td>
<td>0.876 (0.874)</td>
<td>445.242*</td>
</tr>
<tr>
<td>5</td>
<td>Tenant Holdings</td>
<td>45</td>
<td>5.241</td>
<td>0.953</td>
<td>0.004</td>
<td>0.907 (0.905)</td>
<td>421.353*</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level.

Source: Primary Data.

The table IV-2 reveals that the farm size influences the use of bio-chemical inputs positively in all types of farms. But the per acre use of bio-chemical inputs in different farm sizes shows a declining trend. That is, there is a considerable fall in the application of bio-chemical inputs when farm size increases because the application of bio-chemical input does not increase in proportion to land size.

As such the large farms by nature conserve the use of bio-chemical inputs and thus minimize the cost of production and enhances the volume of production.
Figure IV-2
Relationship between Farm Size and Bio-Chemical Input

Source: Appendix Table II.
It has also been stated that when chemical fertilizers are applied more than its requirement, soil fertility is damaged. The conclusions of S.R. Sharma, J.N. Pretty, et al., and S.K. Roy confirm this statement. They opined "It is found that inorganic farming system over the years burns the soil organic matter and soil micro organisms rendering soil lifeless and infertile, spoiling the soil structure and soil health, depleting the soil of the micro nutrients and its natural fertility: this has resulted in stagnant and declining yield, production and income of crops". The farmer’s awareness about these facts coupled with increasing price of fertilizers causes the economical and sensible application of bio-chemical inputs in the study area.

But a slight variation is found regarding own farms. It is observed that the per acre application of bio-chemical input is higher in own farms than in other farms. Mechanisation of agricultural operations has drastically reduced the use of drought animals in agriculture. Thus the number of work animals has been declining progressively both in absolute and relative terms. It has brought down the supply of natural manure. This shortage is compensated by the extensive use of chemical fertilizers by the farmers of own farms. This makes their productivity relatively lower. Thus, the own farms are subject to the adverse effect of over dosage of bio-chemical inputs when compared with other tenurial farms in the study area.
Thus the technological improvement in the form of bio-chemical inputs facilitated the reversal of inverse relationship in the study area. This finding is on par with the findings of the earlier studies.30

(b) Labour Based Explanations

The earlier studies associated the higher productivity of small farms with the intensive use of family labour. But after Green Revolution, this argument lost its validity. Family labour is employed not only in own farms but in all types of farms. In the same way, there is a wide spread use of hired labour irrespective of types and size of farms. But, it is difficult to measure their relative efficiencies.

Further, a considerable fall in the use of labour input is experienced in agriculture recently because of the technical advancement.31 Hence, labour is used only for some specific agricultural operations like bund formation, sowing, for applying pesticides and weeding. However, the role of labour input in agricultural operation is still significant.

Therefore, this study tries to explain the higher productivity of large farms by exploring the relationship between farm size and total labour absorption by employing a simple regression equation which is of the form

\[
\log L = \log a + \beta \log A
\]

where \(L\) = Labour input in terms of man days

\(A\) = Farm size; and

\(\beta\) = Efficiency parameter of \(A\)
The results are presented in Table IV-3.

### Table IV-3

**Relationship between Farm Size and Labour**

<table>
<thead>
<tr>
<th>Regression No.</th>
<th>Type of Farm</th>
<th>Number</th>
<th>Constant Log a</th>
<th>Co-efficient</th>
<th>S.E.</th>
<th>R² (R^2)</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All Farms</td>
<td>285</td>
<td>-0.206</td>
<td>0.834</td>
<td>0.003</td>
<td>0.696 (0.695)</td>
<td>646.673*</td>
</tr>
<tr>
<td>2</td>
<td>Own Farms</td>
<td>130</td>
<td>-0.168</td>
<td>0.829</td>
<td>0.004</td>
<td>0.688 (0.685)</td>
<td>281.802*</td>
</tr>
<tr>
<td>3</td>
<td>Own Holdings</td>
<td>45</td>
<td>-2.080</td>
<td>0.954</td>
<td>0.006</td>
<td>0.910 (0.907)</td>
<td>432.513*</td>
</tr>
<tr>
<td>4</td>
<td>Tenant Farms</td>
<td>65</td>
<td>-0.503</td>
<td>0.921</td>
<td>0.004</td>
<td>0.848 (0.846)</td>
<td>352.639*</td>
</tr>
<tr>
<td>5</td>
<td>Tenant Holdings</td>
<td>45</td>
<td>-0.608</td>
<td>0.933</td>
<td>0.005</td>
<td>0.871 (0.868)</td>
<td>290.786*</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level.

Source: Primary Data

Table IV-3 reveals that the farm size positively influence the labour input in all types of farms. But the degree of relationship is less than unity. This study brings out the fact that the per acre absorption of labour input is high and consistent for own holdings and tenant holdings. The farmers of own holdings have their own labour force. The holdings they own are not sufficient enough to absorb their labour force fully. So, instead of working in other’s farm as wage labour, they leased-in land for cultivation and make their labour force fully absorbed both in own holdings and tenant holdings. Thus, they ensure the effective use of available man power with them. Moreover, their labour is readily available at any point of time. And also, they supplement other inputs with labour input proportionately and didn’t substitute labour for other inputs. These make them to be more productive.
Figure IV-3

Relationship between Farm Size and Labour

Source: Appendix Table III.
On the contrary, it has been observed that use of labour input is too low in tenant farms because of their in-ability to mobilize labour input at an appropriate time. Instead, they concentrate on capital inputs. Their attempt to substitute capital input for labour input has not succeeded in raising the level of output on par with own holdings and tenant holdings. Among the different types of tenurial farms, productivity is relatively higher in own holdings and tenant holdings.

(c) Effective Combination of Farm Inputs and Optimum Size of Farms

Land being a major input for agricultural operations, it must be combined with other factors optimally. The benefits like higher productivity and greater efficiency can only be achieved if the size of holdings is optimum.

Singh defined an optimum holding as, “A certain size at which worker gets the maximum profit per acre”. This definition is stated on the basis of the relationship between costs and yields.

Dandekar viewed that the size of agricultural production unit should be optimum to gain the maximum production through existing amount of resources.

The optimum size of farm will increase the production and productivity of crops through optimum utilization of agricultural inputs. The land holdings less than optimum size are contributing only low level of income to the farmers and thereby discourage the farmers to take risk in adopting modern technologies.
Chokshi\(^36\) pointed out that small farmers dis-continue regular agricultural operations on their small holdings because these holdings don’t provide adequate income to them and they try to have jobs somewhere else. Also, small farms are far from the size of optimum holdings because of their high average cost of production.

This study has made an attempt to identify the optimum size of farm by relating the farm size with the total inputs through regression equation. The equation is of the form,

$$\log I = \log a + \beta \log A$$

where \(I\) = Total inputs

\(A\) = Farm size; and

\(\beta\) = Efficiency Parameter of \(A\).

The results are presented in Table IV-4.

**Table IV-4**

<table>
<thead>
<tr>
<th>Regression No.</th>
<th>Type of Farm</th>
<th>Number</th>
<th>Constant Log a</th>
<th>(\beta) Co-efficient</th>
<th>S.E.</th>
<th>(R^2) ((R^2))</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All Farms</td>
<td>285</td>
<td>6.683</td>
<td>0.917</td>
<td>0.002</td>
<td>0.840 (0.839)</td>
<td>1486.385*</td>
</tr>
<tr>
<td>2</td>
<td>Own Farms</td>
<td>130</td>
<td>6.911</td>
<td>0.909</td>
<td>0.003</td>
<td>0.827 (0.825)</td>
<td>611.057*</td>
</tr>
<tr>
<td>3</td>
<td>Own Holdings</td>
<td>45</td>
<td>4.726</td>
<td>0.961</td>
<td>0.005</td>
<td>0.923 (0.921)</td>
<td>515.793*</td>
</tr>
<tr>
<td>4</td>
<td>Tenant Farms</td>
<td>65</td>
<td>6.802</td>
<td>0.929</td>
<td>0.003</td>
<td>0.863 (0.861)</td>
<td>396.629*</td>
</tr>
<tr>
<td>5</td>
<td>Tenant Holdings</td>
<td>45</td>
<td>6.303</td>
<td>0.951</td>
<td>0.004</td>
<td>0.904 (0.902)</td>
<td>405.199*</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level.

Source: Primary Data
This study shows a high degree of positive relationship between the farm size and the total input absorption in all types of farms. The efficient combination of inputs facilitates maximum output.

A farm which enables to combine all inputs in a more efficient and economical way will be more efficient in terms of its productivity.

This study has found out that the per acre application of total inputs decreases when farm size increases. This implies that the large farms are able to manage with lower input which are available currently and maximize their output.

The tenurial classification shows that the application of total input is relatively higher in own farms than in other farms. It is due to the fact that they are applying more chemical fertilizers than other farms. It is also identified that the lower amount of labour input and bio-chemical input causes the lower total input for tenant farms.

So, it is inferred that large farms gain the advantage of effective combination of all inputs. The result of this study is in accordance with the findings of P.K. Bardhan. He concluded that it was the combination of total inputs and not of modern inputs alone which explained the higher productivity of large farms.
Figure IV-4

Relationship between Farm Size and Total Input

Source: Appendix Table IV.
This study concludes that the farms having 4-5 acres of land is considered as optimum because of cost advantage and productivity. The total input use in this range is too low which implies that the average cost per acre is comparatively low and the productivity is too high in all types of tenures. Soltani\textsuperscript{40} is also of the same view that large farms performed better in terms of cost per unit of output and net income per acre than small farms.

Mahipal\textsuperscript{41} concluded that the optimum size of farm cannot be fixed for all time. It varies area to area and situation to situation.

d) Capital Oriented Explanation

Modern agricultural technology is highly capital oriented. It includes the services of tractors, harvesters, etc. Hiring the services of farm equipments and machineries have been rising strategically so as to reduce the animal and human labour which entails still higher maintenance cost.

This study also brings out the relationship between farm size and the capital usage. A simple regression equation in the form

$$\log C = \log a + \beta \log A$$

is used to explore the relationship.

Here, $C$ = Capital input

$A$ = Farm size; and

$\beta$ = Efficiency parameter of $A$.

The result of this analysis is shown in Table IV-5.
Table IV-5

Relationship between Farm Size and Capital Input

<table>
<thead>
<tr>
<th>Regression No.</th>
<th>Type of Farm</th>
<th>Number</th>
<th>Constant Log a</th>
<th>$\beta$ Co-efficient</th>
<th>S.E.</th>
<th>$R^2$ (R²)</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All Farms</td>
<td>285</td>
<td>8.641</td>
<td>0.973</td>
<td>0.014</td>
<td>0.948</td>
<td>5119.556*</td>
</tr>
<tr>
<td>2</td>
<td>Own Farms</td>
<td>130</td>
<td>8.647</td>
<td>0.974</td>
<td>0.020</td>
<td>0.949</td>
<td>2364.441*</td>
</tr>
<tr>
<td>3</td>
<td>Own Holdings</td>
<td>45</td>
<td>8.566</td>
<td>0.995</td>
<td>0.014</td>
<td>0.990</td>
<td>4450.703*</td>
</tr>
<tr>
<td>4</td>
<td>Tenant Farms</td>
<td>65</td>
<td>8.760</td>
<td>0.964</td>
<td>0.034</td>
<td>0.930</td>
<td>836.562*</td>
</tr>
<tr>
<td>5</td>
<td>Tenant Holdings</td>
<td>45</td>
<td>8.590</td>
<td>0.981</td>
<td>0.029</td>
<td>0.962</td>
<td>1078.939*</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level.
Source: Primary Data

Table IV-5 exhibits that the farm size positively influences the capital input for all types of farms. The per acre utilization of capital is high for tenant farms and low for own holdings.42

It is inferred that tenant farms dump capital input and restrict the labour input drastically and this caused fall in productivity. But, own holdings use both capital and labour input reasonably and this helped them to gain productivity advantage.

This study reveals that the machine labour’s share in the total cost of production of large farms has risen sharply.43 Agricultural operations must be done at a specified period of time. Otherwise it will cause damages to the produce and lead to acute loss. So, timely operation is more important.
Figure IV-5

Relationship between Farm Size and Capital Input

Source: Appendix Table V.
There was a rapid rise in wage rate for human labour for agricultural purpose. And also, their services are not available during busy seasons. So, capital inputs are used more in this area because of their timeliness, quality of work and their availability at all times at competitive rates.

Since the large farmers are able to enjoy the advantage of capital mobilisation, they are in a position to avail the services of capital equipments than small farmers. Thus, the capital inputs play an important role in promoting agricultural productivity of large farms in the study area.

B. Farm Size - Productivity and Profitability Relationship

Profit is the motive power for any economic activity. Unlike industry and trade, profit in agriculture is subject to many uncertainties. The earlier farm studies whether they debated about the existence of inverse or positive relationship with farm size and productivity, they agreed with the existence of positive relation between farm size and profitability.

Since profitability is associated with efficiency, larger farms automatically gain advantage. So, it becomes essential to understand the causes for the lower profitability of small farms.

The motives for agricultural operations in earlier days were self-sufficiency and food security. But, now the issue of profitability has gained more importance because of Green Revolution. Further investment decisions also depends on the profitability of the present agricultural activities.
Hence, it is imperative to test the relationship between farm size and profitability. So, an attempt in this regard has been made in this study.

B (i) Farm-Size and Farm Business Income

One could understand the profitability of the farm only if the farm size or farm business income is known. Therefore a study showing the relationship between farm size and farm business income is essential. Farm business income is the income from farm business that remains with the family after deducting the paid-out costs from the gross money value of output. So, lower the paid-out costs, higher will be the net farm business income. So, a rational farmer tries to minimise the paid-out costs in order to make his farm to be more efficient in terms of higher farm business income. Higher the efficiency of the farm larger is the volume of farm business income.

The relationship between farm size and farm business income is identified by applying a simple regression which is of the form,

\[
\log \text{FBI} = \log a + \beta \log A
\]

where

FBI = Farm Business Income

A  = Farm size; and

\( \beta \) = Efficiency parameter of A

The estimated results are presented in Table IV-6.
Table IV-6

Relationship between Farm Size and Farm Business Income

<table>
<thead>
<tr>
<th>Regression No.</th>
<th>Type of Farm</th>
<th>Number</th>
<th>Constant Log a</th>
<th>$\beta$ Co-efficient</th>
<th>S.E.</th>
<th>$R^2$ ($R_2$)</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All Farms</td>
<td>285</td>
<td>6.513</td>
<td>0.724</td>
<td>0.004</td>
<td>0.524 (0.523)</td>
<td>311.878*</td>
</tr>
<tr>
<td>2</td>
<td>Own Farms</td>
<td>130</td>
<td>6.095</td>
<td>0.707</td>
<td>0.007</td>
<td>0.500 (0.496)</td>
<td>128.086*</td>
</tr>
<tr>
<td>3</td>
<td>Own Holdings</td>
<td>45</td>
<td>5.237</td>
<td>0.931</td>
<td>0.007</td>
<td>0.867 (0.864)</td>
<td>279.908*</td>
</tr>
<tr>
<td>4</td>
<td>Tenant Farms</td>
<td>65</td>
<td>6.755</td>
<td>0.885</td>
<td>0.005</td>
<td>0.782 (0.779)</td>
<td>226.465*</td>
</tr>
<tr>
<td>5</td>
<td>Tenant Holdings</td>
<td>45</td>
<td>6.685</td>
<td>0.925</td>
<td>0.005</td>
<td>0.856 (0.853)</td>
<td>256.084*</td>
</tr>
</tbody>
</table>

*Significant at 0.01 level.
Source: Primary Data

This analysis reveals that farm size positively influences the Farm Business Income but less than proportionately in all types of farms.

The farmers in the study area instead of owning the capital equipments like tractor, harvester, etc. hire the services of these equipments by offering piece rates. And also, the services of labour units become costly during busy seasons since they are demanded more. These make a hike in the paid out cost. However, the large farms are input conserving in nature and so the impact is neutralised. Thus, the farm business income has a tendency to increase in relation with the farm size. Among the various types of farms own holdings and tenant holdings earn more.
Figure IV-6
Relationship between Farm Size and Farm Business Income

Source: Appendix Table VI.
The findings of this study deviate from the findings of Khusro and Usha Rani. Khusro states the existence of inverse relationship between farm size and farm business income while Usha Rani opines that the farm business income is invariant with the size of holdings.

B(ii) Farm Size and Net Profit

As stated earlier, Net profit is also a measure of farm efficiency. It can be obtained by deducting the imputed costs from the net farm business income. It is the yardstick which shows the pure efficiency of farms. In the study area 7 farms incurred loss. So they are excluded from the regression estimation.

This study has also made an attempt to find out the efficiency of farms by relating the net profit with farm size by using simple regression technique. The form of equation is,

\[ \log NP = \log a + \beta \log A \]

where \( NP \) = Net Profit

\( A \) = Farm Size; and

\( \beta \) = Efficiency Parameter of A.

The results are depicted in Table IV-7.
The Table IV-7 exhibits the positive influence made by the farm size on net profit. The profitability of own holdings is much higher than that of other types of farms.\(^{47}\) It is due to their planned performance and appropriate decisions regarding input mix, timely application of inputs and selling the produce. They also make use the available resources fully.

It is also observed that the per acre net profit of tenant farm is much lower than for other type of farms. The reason is four fold.

a) The lumpiness of capital input made on the farm and the higher service charges for the capital inputs pushed up their cost of production.

b) The labour input used is too low. It is inferred that improper substitution of capital for labour input causes lower profitability of tenant farms.
Figure IV-7
Relationship between Farm Size and Net Profit

Source: Appendix Table VII.
c) The tenancy system prevailed here is also not in favour of the tenants. Mostly, share cropping system is in existence; and

d) Selling of produce at the time of reaping fetches only lower prices and reduce the money value of output.

This study reveals that profit is the reward for systematic and planned farm activities. The fullest utilization of available resources also increases the net profit. The study by Begai and Soni[^48] also affirm this finding.

C. Relationship between Productivity and Profitability

The relationship between Productivity (money value of output) and net profit has been explained by means of a regression equation in the form of

\[ \log P = \log a + \beta \log Y \]

where \( P \) = Net Profit

\( Y \) = Productivity; and

\( \beta \) = Efficiency Parameter of \( Y \).

The results are given in Table IV-8.
Table IV-8

Relationship between Productivity and Profitability

<table>
<thead>
<tr>
<th>Regression No.</th>
<th>Type of Farm</th>
<th>Number</th>
<th>Constant Log a</th>
<th>β Co-efficient</th>
<th>S.E.</th>
<th>R²</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All Farms</td>
<td>278</td>
<td>-2.425</td>
<td>0.776</td>
<td>0.054</td>
<td>0.602(0.601)</td>
<td>417.701*</td>
</tr>
<tr>
<td>2</td>
<td>Own Farms</td>
<td>123</td>
<td>-3.465</td>
<td>0.880</td>
<td>0.060</td>
<td>0.774(0.772)</td>
<td>414.335*</td>
</tr>
<tr>
<td>3</td>
<td>Own Holdings</td>
<td>45</td>
<td>-0.614</td>
<td>0.984</td>
<td>0.028</td>
<td>0.968(0.967)</td>
<td>1292.474*</td>
</tr>
<tr>
<td>4</td>
<td>Tenant Farms</td>
<td>65</td>
<td>-4.526</td>
<td>0.799</td>
<td>0.116</td>
<td>0.638(0.633)</td>
<td>111.210*</td>
</tr>
<tr>
<td>5</td>
<td>Tenant Holdings</td>
<td>45</td>
<td>-0.775</td>
<td>0.986</td>
<td>0.026</td>
<td>0.972(0.971)</td>
<td>1472.342*</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level
Source: Primary Data

Table IV-8 shows that productivity positively influences profitability but less than proportionately in all types of farms.

In order to facilitate comparison, the ratio of profit to production for different income groups was prepared. It is too high and consistent for own holdings (0.52) and too low (0.15) for tenant farms.49

The higher productivity of own holdings and the fullest utilization of available resources are the twin causes for their higher profitability. Lack of capital conservation and prevalence of share cropping tenancy system which is not conducive to the tenant farmers make the tenant farms less profitable.

Since profitability is associated with productivity, the loss making units are not included in this analysis.

This study infers that profitability is the by-product of productivity.

Both of them are the indicators of efficiency.
D. Conclusions

1. There exists positive relationship between farm size and productivity. But degree of relationship is closer to unity in all types of tenurial farms. The first hypothesis that an inverse relationship exists between farm size and productivity in the production of paddy has been disproved.

2. The causes cited by the earlier studies for the inverse relationship between farm size and productivity such as pre dominance of cheap family labour, intensive use of land and labour, effective supervision and management, improved irrigation, usage of better quality soil and other inputs, policy of the government and the form of tenancy are not valid in the study area.

3. Technological improvement in the form of bio-chemical inputs facilitated the reversal of inverse relationship.

4. The economic and sensible application of bio-chemical inputs leads to higher productivity as farm size increases.

5. Productivity and profitability are higher in own holdings and tenant holdings than for other types of farms. Proper channelisation and fullest utilization of available man power and its rational supplement with other factor inputs account for positive relationship in the study area.

6. Productivity of large farms is higher than the small farms. Efficient combination of all factor inputs paved a way for higher productivity of large farms.
7. Farms having 4 to 5 acres are of optimum size farms in all types of tenurial farms since they have lowest average cost of production and higher volume of output than farms of other size.

8. The capital input played an instrumental role in promoting agricultural productivity of large farms.

9. Farm business income has the tendency to grow with the farm size.

10. Farm size positively influences net profit.

11. The planned performance and appropriate decisions regarding input mix, timely application of inputs and selling of the produce make the profitability of own holdings much higher than that of other types of farms.

12. Higher service charges for capital inputs, improper substitution of capital for labour, the prevalence of share cropping system and fetching lower prices for the produce are the causes for the lower per acre net profit of tenant farms.

13. Profitability is the by-product of productivity in all types of farms.

14. The ratio of profit to production is too high and consistent for all levels of output in own holdings and too low for tenant farms.
Notes and References


6. It is the peculiar characteristic of human labour.


21. See Appendix Table I.


25. See Appendix Table II.


32. See Appendix Table III.

33. See Appendix Table III, V and I.


37. See Appendix Table IV.

38. See Appendix Tables III and II.


41. Mahipal, (1992). *Land Productivity and Employment in Indian Agriculture – A Case Study of Meerut Region*. (New Delhi : Mittal Publications), PP.45-46. Since this is a cross section study and concentrates on a single area, no attempt has been made in this regard.

42. See Appendix Table V.

43. See Table VII -8.

44. See Appendix Table VI.


47. See Appendix Table VII


49. See Appendix Table VIII.