Chapter III

Review of Literature
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I. Studies on Farm Size- Productivity Relations

(A) Theoretical Approach

The relationship between farm size and productivity remain in-conclusive.\(^1\) Some economists felt that inverse relationship holds over 'certain ranges of size' and not over 'all ranges of size'.\(^2\) A 'U' shaped effect of farm size on outcomes was identified by Carter and Wiebe and Heltberg.\(^3\)

Upto mid-sixties, there was no conclusive proof to disprove the negative relationship which was established by Sen\(^4\) and approved by Dipak Mazumdar,\(^5\) A.M. Khusro,\(^6\) Raj Krishna\(^7\) and B.R. Kalra.\(^8\) Ashok Rudra\(^9\) challenged the generalized theory of Sen.\(^10\) He concluded that when gross sown area is considered as a measure of land input, and if the land is intensively used, inverse relation is ruled out. After the introduction of green revolution, the debate gained much importance and much more concentration was made on this issue.

C.H. Hanumantha Rao\(^11\) noted the size – negative relationship at the higher range. He opined "It is evident from the farm management studies that inputs and outputs per acre decline consistently with size holdings above 10 acres".
The studies conducted by G.R. Saini, Bhattacharya and Saini also confirmed the inverse relationship between farm size and productivity.

In the later part of seventies, weakening of inverse farm size productivity relationship was proved by Chadha, Soltani, Berry and Cline and M. Khan. Soltani opined that the large farms have performed better in terms of cost per unit of output and net income per hectare than most of the small farms. G.R. Saini observed that after green revolution inverse relationship yielded place to positive relationship.

By observing the trend, Ashok Rudra and A.K. Sen attempted a synthesis of their views and re-stated as "While inverse relationship may hold in certain areas, it is not a universal phenomenon and cannot be said to operate in all parts of the country. So, one could not possibly observe any systematic pattern of dependence between yield per acre and farm's size".

**(A)(i) Nature and Causes for Positive and Inverse Relationships**

The farm size productivity debate explored the causes for positive and inverse relationships.

Prof. Amartya Sen elucidates the usage of family labour in small farms causes inverse relationships. In under-developed countries, since the opportunity cost for labour is very low, the small farmers use family labour abundantly and extend the cultivation up to the point where the marginal productivity of labour may approach zero or negative. But in large farms,
hired labour is used up to the point where the marginal productivity of hired labour equals the ruling wage rate. So in small farms, the output per acre and in large farms, the output per unit of labour is maximized" he adds.

Mazumdar\(^{21}\) is of the view that since family labour is cheap, there is a chance for using more of that labour and that enhances the labour to land ratio on small farms. Also there is less uncertainty about the effort with family labour than hired labour. This also causes small farms more effective.

It is the imperfect land and labour markets that make inverse relationship according to Bardhan.\(^{22}\) He noted it as one of the "stylized facts" of traditional agriculture.

Yotopoulos and Lau\(^{23}\) opined that advantages in hired labour supervision makes the small farms of Indian agriculture more effective.

Sen\(^{24}\) ascertained that the small farmers have own labour. They are desirous to work in their own field rather to work for some one else. They present in the field voluntarily and work hard. On contrary, the hired labour employed in big farms absent from their work frequently and asks more wages. This makes small farms more effective.

Carter\(^{25}\) observed that inverse relationship is due to better quality of soil, mode of production, technical efficiency, village specific factors and diminishing returns to scale.
"More intensive use of labour for each crop, more use of the available land, choosing of labour intensive crops, using own labour for land improvements gives small farms a productivity advantage over large farms. But with the advent of green revolution technology, the small farmers lost this advantage. Absence of technical extension and credit services prevent the small farmers to use these technologies" according to Cornia.\textsuperscript{26}

For small farms, land and capital are more expensive and labour is cheaper. This enhances the labour supply in the labour market and makes the wage tend towards zero. But the wage will not fall below some minimum caloric requirement. Large farms hire labour up to the point where marginal product of labour equals the minimum caloric requirement. This causes unemployment and so the opportunity cost of employing family labour will be low on smaller farms. So, small farms employ more labour force and hence higher productivity is observed.\textsuperscript{27}

The intensive use of family labour by small farms is identified by Boyce\textsuperscript{28} and he reveals two factors for the in-efficiency of big farmers.

(i) As the ratio of hired to family labour rises, supervision becomes more time consuming and less effective; and

(ii) As the social distance between the supervisors and the hired labour increases, the effectiveness of supervision will decrease.

The earlier theories considered uniformity in the quality of soil. But the very existence of variations in soil fertility was observed by Ricardo.
Bhalla and Roy\textsuperscript{29} found that the inverse relationship weakens considerably after differences in soil quality are taken into account. They argued that agro-climatic conditions and soil quality, crucial determinants of agricultural productivity and so measures of farmer’s investment in soil quality must be included in investigations of said productivity. They stressed the importance of maintaining the fertility of soil through constant efforts.

A.M. Khusro\textsuperscript{30} viewed that as farm size expands, the proportion of bad and indifferent land to total land increases and this in turn accounts for the decrease in per acre output and farm income.

The amenities available to the larger farms must make their productivity much more than the small farms. But the result obtained is paradoxical in nature. The indivisible factors have higher impact on small farms than larger farms may be a cause for this phenomenon. A.M. Khusro\textsuperscript{31} pointed out that ‘A small farm with surplus bullock power with very low opportunity cost for them will intensify bullock use and hence obtain a large per acre output’.

Jagdish Bhagwati and S. Chakravarthy\textsuperscript{32} viewed that fragmentation makes the small farms more effective. He writes “if under circumstances, the reasonably small farmers are resorted to sell their lands to landlords, first they sell out the poor quality land and hold the better quality land”. But this theory did not consider the buyer’s behaviour.
In nineties, the bare subsistence for the small farmers theory was gained momentum. It is for their basic livelihood, small farmers strive hard. In the words of Dyer, while differential factor prices, property rights and tenure play a part in this phenomenon, the inverse relationship reflects the desperate struggle of poor marginal peasants to scratch a bare subsistence.

Since the peasant farmers have no other base for their living, they have to conserve the land in order to produce more. Byiringiro and Reardon opines that higher land conservation efforts on small farms make them more productive than large farms.

Barrett shows that cropping patterns are responsible for part, but not all, of the inverse relationship. He also viewed that food price risks that create food security stress induce small farms to utilize more farm labour and produce more.

In a number of states including Assam, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Orissa and Rajasthan, the net returns per hectare are so low as they are based on traditional crop farming. The small and marginal farmers don’t earn enough to stay above the poverty line.

Subba Reddy viewed that in a rural economy of semi-feudal character allowing for unmanageably large farms, the landlords hold the land for the sake of prestige and not for carefully calculated economic returns. The efficiency of farm management must be negatively correlated with size at that
level. But a small farmer using his family labour and investing personal care may be able to produce more per acre than large farms.

On contrast, Binswanger et al.,\textsuperscript{38} are of the view that economies of scale in production and lumpiness of some modern inputs such as machinery are supposed to favour larger farms.

Non-availability of capital to the small land holdings makes their productivity as lower because capital inputs are in the form of new technology, machineries, improved ways of irrigation, improved varieties of seeds, fertilizers and pesticides. Kevane\textsuperscript{39} is of the view that insurance and financing constraints faced by poorer farm households lead them to adopt less profitable strategies of cultivation. This, in turn, make the small holdings inefficient than large ones.

Fafchamps,\textsuperscript{40} Omamo\textsuperscript{41} and Dorward\textsuperscript{42} are also of the same conclusion. They viewed that the small farms being subsistence concerns adopt themselves to specialize in less profitable crops reap only lower productivity. Big farms being wealthy concerns adopt for more profitable crops and thereby produce more.

"The price and other policy distortions that are lower in larger farms may also cause a positive effect of size productivity relationship" added sawers.\textsuperscript{43}
Dorward\(^44\) once again found out the availability of land for cultivation as a factor determines the relationship between farm size and productivity. He ascertained that the inverse relationship may be observed in land scarce areas while a positive relationship would dominate in land abundant areas.

More intensive use of mechanization on larger farms also causes positive relationship.\(^45\) But the land owners must have a positive mind to accept and introduce in their farms since it is a costly affair.

The high capital-land ratio may also be a cause for higher productivity of large farms. Dyer\(^46\) observed it and concluded that large land owners have access to land and credit and small farmers do not. Thus, the larger farms are more capital intensive and thereby weaken the inverse relationship. If land and capital are combined together, it may lead to increased productivity.

Dyer\(^47\) opined that the policy of the Governments also influences the farm size-productivity relationship. The Government of West Bengal and Egypt adopted a policy of restricted use of machineries in agriculture. This ultimately resulted in the re-appearance of inverse relationship because the replacement of machineries by the increased usage of hired labour in large farms led to lower productivity in those farms.
The location of cultivable land also determines land productivity. Since land is a gift of nature, some lands are blessed with fertility by itself and they are also scarce in nature. Newell, Pandyal and Symons\textsuperscript{48} substantiate this view. They argued that in Gujarat, farms are smaller in fertile regions and so the output per hectare is larger on small farms. They are also of the view that the inverse relationship is a result of differential factor use intensity.

Eventhough the improved technology is supposed to favour the large farms, they also support the smaller farms to raise their productivity. In earlier days, the small farmers could not afford to these technologies as they were capital consuming, gigantic in size and lacked mobility. But now, the latest technologies are available according to the requirements of the small farmers. So, they are of beneficial to the small farmers also. Sharma and Sharma\textsuperscript{49} viewed that the negative relationship between the farm size and productivity is due to the fact that small farmers are reaping the benefits of new technology.

The able farmers wish to have only small farms in order to involve fully in farming activities. This will enhance their productivity. Assuncao and Ghatak\textsuperscript{50} in this regard opined that the high ability farmers are self-select into small farms in order to exhibit their ability in terms of output.

In the late nineties, it was realised that the management factors also influence the efficient use of resources and land productivity. Selvarajan, et al.,\textsuperscript{51} list out a number of management factors such as timeliness
and method of sowing, transplanting, irrigation and application of right doses of inputs and input mix play an important role in influencing inter-farm variation in crop productivity. By analysing the wheat crop in Punjab, Singh, et al.,\textsuperscript{52} viewed that there is scope for raising the crop yield through improved farm management practices.

It is also said that the generalized inverse relationship between land size and productivity does not hold good if the land size is too large. Eswaran and Kotwal\textsuperscript{53} viewed that modern input which lead to yields that are decreasing with farm size for relatively small farms also leads to increasing yields with farm size above a certain size threshold.

(A) (ii) A State of Constancy

Unlike the existence of positive or negative relationships between size of farm and productivity, there exists a neutral effect also. It implies that the farm size has no influence on productivity. A.P. Rao\textsuperscript{54} contends that once the current fallow is excluded in determining size of holding and differences in proportion of irrigation are ruled out in village level, gross output appears to remain constant irrespective of size.

By analysing the relative efficiency of wheat production in Punjab, S.S. Sidhu\textsuperscript{55} observed no variation in efficiency between different farm sizes. A village level study conducted by Bliss and Stern\textsuperscript{56} also affirmed it.
Kurien made a study on farm management in Thanjavur and Coimbatore and state that the new techniques of production are size neutral and that small and big farmers are performing alike in the cultivation of high yielding varieties.

Lamb was of the view that the inverse relationship could not be explained only on the grounds of un-considered land quality differences or imperfections in rural market, but after instrumenting farm size (assuming it is measured with error) the inverse relationship is almost entirely washed away.

(B)Empirical Studies on Size-Productivity Relations

It is presumed in the mid-fifties and early sixties by the Indian economists that small farms were more productive on a per hectare basis than larger farms. Since 1954-55, the studies in the Farm Management undertaken by the Government of India provided a statistical base for the Indian economists to work out the relationship between farm-size on the one land productivity and efficiency on the other. This attracted the researchers to work in this field to ascertain the relationship between farm-size and productivity.

The initial debate started with the publication of Amartya Sen's paper based on the data provided by the studies in the Economics of Farm Management. It was ascertained that by and large, productivity per acre decreased with the size of holdings. He provided three proposition regarding farm size, productivity and profitability.
1. If family labour employed in agriculture is given an impounded value in terms of the prevailing wage rate, much of Indian agriculture seems unremunerative.

2. By and large, the profitability (surplus of output over costs including the imputed value for labour) of agriculture increases with the size of holding; and

3. By and large, productivity per acre decreases with the size of holding.

Sen argued that in the case of large farms the farmer will employ hired labour up to the point where marginal productivity of labour equals wages. Because, employment of labour beyond that level may bring about loss.

But the small farms, since they own home labour, may employ labour till their marginal productivity equals zero. Accordingly, the labour-land ratio is higher for small farms and this keeps their productivity more as compared to large farms.

Hanumantha Rao made use of the data on individual farms taken from (a) Farm Management Survey, Bombay and (b) the Survey conducted by the Institute of Economic Growth, Delhi. The farmers belong to Bombay and Andhra Pradesh. The reference period was 1955-56. With the regression analysis he found inverse relationship between size of holding and productivity. The results indicate diminishing returns to size of land holding.
Rudra\textsuperscript{61} took a sample of 1198 farms from 20 villages selected in Punjab, Haryana and Western Uttar Pradesh. Of this, data on 163 holdings of the 20 villages were considered for finding out the relation between farm size and productivity. Size of land holding and yield per acre are the two variables he used. He divided the gross value of output by the gross cultivated area for computing the yield per acre. He concluded that for the holdings upto 20 acres, there exist a positive relationship and the productivity starts declining for the holdings above 20 acres in one village while productivity increased in the another village.

Vyas and others\textsuperscript{62} in a cross-sectional study found positive relationship between size and scale of production. The reasons ascertained by them for this phenomena are: (i) the small farmers are not capable of facing the uncertainties associated with the cultivation of high yielding crops; and (ii) the small farmers lack investible funds for purchasing modern inputs which are required for intensive cultivation.

Usha Rani\textsuperscript{63} used the farm management data collected by the Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, from a sample of 1431 farms selected from five Intensive Agriculture Development Programme Districts. She made use of regression analysis and confirmed that farm's business income is invariant with the size of land holdings. She also ascertained that the net income increases with the increase in the size of land holding.
Bhattacharya and Saini\textsuperscript{64} selected two districts, Ferozepur in Punjab and Muzaffarnagar in Uttar Pradesh and conducted a village-wise study. They concluded that an inverse relationship exists between farm size and productivity in Muzaffarnagar district whereas it does not hold good in Ferozepur district.

Singh and Patel\textsuperscript{65} selected two blocks in Meerut district which are concentrating on Mexican Wheat Production during the post green revolution period to examine the inverse relationship. Regression co-efficient and t-test were employed. They concluded that green revolution has positive impact on land size and productivity trends.

Bharadwaj\textsuperscript{66} on the basis of studies on Economics of Farm Management Data in 1974 analysed the farm size productivity relations. She considered that factors like cropping pattern, intensity of cultivation, level of irrigation, distress as well as subsistence level of living conditions influence the productivity of small farms significantly.

It is mostly desperation for survival arising from vulnerability of their economic handicaps that compel them to use greater intensity in cultivation work.

She also opined that higher percentage of irrigated area in the small farms relative to larger farms also causes inverse relationship. She statistically disclosed three reasons for this phenomenon.
(i) Irrigated land is widely fragmented.

(ii) Irrigated land is leased out in small parcels by the landlords to maximise returns; and

(iii) Small farmers with family labour may create and maintain irrigation facilities of their farms.

She concluded that irrigation contributed a lot for the cultivation of lucrative cash crops and for multiple cropping. It also acts as a stimulating agent for intensifying the use of other inputs like human and bullock labour.

C.H.H. Rao\(^6\) made a study on the basis of the Post Green Revolution period data collected by the studies in the Economics of Farm Management. He ascertained that under traditional technology, there is inverse relationship between farm size and output per acre. But the inverse relationship is no longer true with the adoption of new technology.

He also found that inverse relationship was statistically significant during fifties but adoption of new technology during sixties has weakened this relationship in Ferozepur (Punjab), West Godavari (Andhra Pradesh) and Muzaffarnagar (Uttar Pradesh).

Djurfeldt and Lindberg\(^6\) have done a micro level study in a colonial village Thayiyur in Chengalpattu district to ascertain whether poverty was a phenomenon for underdevelopment.
They found that the average yield of paddy in this village remained at 350-400 Kg per acre in 1969 as against an average yield of 692 Kgs per acre in Chengalpattu district.

Since the primary goal of the farmers was subsistence, they continued to live as small farmers. The yield per unit of land does not vary with farm size in this village. The subsistence peasant farming which may be looked upon as under-development in one sense was the only rational means of existence under the prevailing conditions.

In this village, 67.6% of the holdings were less than 1 ½ acre and 11.9% of the holdings were between 1 ½ to 3 acres. Only 5.3% of the holdings measured more than 10 acres.

Rudra confirmed the inverse relationship by using the aggregated survey report of studies in the Economics of Farm Management. He mentioned that the higher production in small farms are not only due to their usage of family labour, indivisibility of capital, superior quality of land and better management but also due to the factors which drive them for their intensive effort seems to be their need for survival. Hence, he hold the view that, “it is not their relative efficiency rather distress conditions that matter most”.

G.K. Chadha took a farm level data for three agro-climatic regions in Punjab for the year 1969-70 and asserted that due to the impact of new technology, the cropping patterns have so changed that they are no more a
source to know the significant farm-size differences and the value of output per acre. He also found that the inverse relationship had ceased to hold in the more dynamic zones dominated by tube well irrigated maize cultivation. So, the difference in productivity must be explained by other factors.

A study conducted by M. Khan\textsuperscript{71} in the Indus basin of Pakistan provides a concrete evidence for the breakdown of the inverse relation after the introduction of the better technology by green revolution.

Saini\textsuperscript{92} based on the 25 sets of dis-aggregated data collected from a state in North India analysed the relationship and came to a conclusion that the inverse relationship exists between farm size and productivity.

Ajithkumar Ghosh\textsuperscript{73} analysed the farm productivity in India among the two types of farms - peasant and tenant. He defined that peasant farms are those which use 50\% or more family labour of the total labour employed in production and the farms which lease or rent out at least some of the land they operate come under tenant farm category.

He found that the intensity of labour and other inputs vary inversely with farm size of all types of farms. His study also revealed that an inverse relationship exists between farm size and output per acre for all farms. He ascertained that the allocative efficiency of small farms is not due to the superiority of peasant organisation of production, but due to the abundant use of both family labour and farm yard manure. But he hypothesized that this advantage would disappear with technological progress.
A.B. Deolalikar\textsuperscript{74} in his study on Indian agriculture traced the inverse relationship geographically and found that the inverse relationship holds good for the traditional sector. But the effect of green revolution has wiped out the inverse relationship.

Bliss and Stern\textsuperscript{75} conducted a study in Palanpur village of Moradabad district of Uttar Pradesh and came to a conclusion of neutrality between Farm Size and Productivity.

Muhammad Masum’s\textsuperscript{76} study based on the Farm Management data for 127 farms in Phulpur Thana of Mymensingh District, collected by the Bangladesh Institute of Development Studies for the year 1969-70 analysed farm-size, productivity and unemployment relationships among three cropping seasons (Aus, Aman, and Boro) in Bangladesh by using Cobb-Douglas Production function. The study concluded that there exists an inverse relationship between farm size and productivity per acre of net cultivated land for the whole year.

Cheapness of family labour, lack of close personal care on large farms, variation in cropping pattern, higher cropping intensity, remunerative cropping pattern, greater leisure preference of the large farmers are probable causes for the inverse relationship.
Sircar and Heady\textsuperscript{77} concluded that there is an inverse relationship between farm size and productivity by conducting a survey in Birbhum district of West Bengal.

Feder\textsuperscript{78} analysed the relation between farm size and productivity by considering three factors viz. role of family labour, supervision and credit constraints. He found inverse relationship between farm size and productivity due to the following reasons.

1. Family labour is more efficient than supervised (hired) labour.
2. Family labour is more motivated than hired labour and can supervise the latter; and
3. The supply of working capital is directly related to farm-size.

Verma and Bromley\textsuperscript{79} concluded that lack of off-farm employment opportunities to the family labour make the small farmers to the differentiated use of this factor in the production process. This causes increased productivity of small farms.

Carter and Wiebe\textsuperscript{80} analysed the agricultural productivity in Kenya in relation with the cost and access to credit. They concluded that small farm's hyper productivity is overwhelmed by capital constraints. More credit at low rate of interest can easily be floated by the large farms from the monetary institutions. But small farms got loans from the moneylenders at high interest rate. Thus, cost and access to credit minimize the productivity of small farms.
Mahipal conducted a study on land productivity and employment in Indian agriculture in the five districts of the rural part of Meerut region. A multi-stage stratified random sampling technique was adopted for selecting sample for this study.

Among the 75 blocks of those five districts, 15 blocks were selected in proportion to the strength of blocks in the district concerned. Randomly, 24 villages were selected from these 15 blocks on the basis of the strength of villages in the block concerned.

The operational holdings in the selected 24 villages were grouped into 14 according to their size. Among the 5953 operational holdings in 24 villages, 265 samples were selected in proportion to the strength of operational holdings in the village concerned.

The reference period of this study was July 1983 to June 1984. The simple average method and log-linear regression model were used to know the relation between farm size and productivity. In order to examine the impact of other inputs on agricultural productivity, the log-linear multiple regression function was used. Cobb Douglas production function was employed to estimate the extent of disguised unemployment and the marginal value of product. The quartile deviation and Lorenz curve method were used to study the disparities in income. He concluded that there exists a positive relationship between the size of land holding and agricultural productivity in terms of output per hectare and net income and inverse relationship exists
between farm size and productivity on medium farm and no relationship exists between farm size and farm business income.

Frisvold\(^2\) analysed the impact of supervision on agricultural productivity by using Indian farm level data. He found that in large farms where hired labour is employed, they have to be supervised because the effects of weather and climatic conditions make them to be away from work.

But small farms where family labour is employed. There is no problem of monitoring their work. This results in the inverse relationship between farm size and productivity.

He also advocated the large farms for the adoption of labour saving technology so as to become efficient.

Chattopadhyay and Sengupta\(^3\) made use of the dis-aggregated farm data for 60 villages in West Bengal which consist of six agro-climatic zones based on cultivation practices, types of soil, irrigation facilities and rainfall. The data collected by the Indian Ministry of Agriculture for the period 1989-1990 were used and analysed the relationship between farm size and productivity by employing log-linear regression model.

They concluded that the inverse relationship between farm size and productivity was stronger in the agriculturally developed regions of West Bengal compared to the relatively less developed regions. This was due to the effect of green revolution on the smaller farms.
Masterson and Rao\textsuperscript{84} used 1991 agricultural census and analysed the Paraguayan agricultural productivity. They confirmed that the larger farms have higher capital–land ratio in Paraguay and that paved a way for weakening the inverse relation between farm size and productivity.

H.R. Sharma and others\textsuperscript{85} analysed the farm-size productivity relationship at the village level in Indora Block of Kangra district - a most agriculturally developed region of Himachal Pradesh. They adopted two stage random sampling procedure to select the sample households. At the first stage, 9 villages (i.e. 10\% of the total villages) were randomly selected. Then among these 9 villages, by random 120 households were selected in proportion to the number of households in each village.

Personal interview method was adopted to collect information from the selected households. This is a cross-section study covering the period of 1997-98. They made use of simple averages and standard deviations in order to compute the mean value productivity and inputs use in different crops. Rank correlation co-efficient was used to compute the relation between farm size and gross value productivity and farm size and inputs use among different villages. The regression analysis was also used in order to estimate the effect of farm size on value productivity and inputs use.

Their findings are presented under two categories.
a) Farm Size and Productivity

i) Villages with lower farm size had higher value productivities though the difference was not so pronounced.

ii) The co-efficient of rank correlation between farm size and value productivities of paddy, wheat and all crops taken together across the villages were negative.

iii) The effect of farm size on yield rates of paddy was negative in all the nine villages. But in two villages the relationship was insignificant.

iv) For other crops, the relationship was positive in five villages but it was significant in only one village.

v) For the remaining four villages, the relationship was negative but insignificant.

vi) If gross value productivities of all the crops were pooled, the effect of farm size was positive but insignificant in two villages; and the result was negative in the remaining villages and significant only in three villages.

b) Farm Size and Inputs Use

i) In case of paddy, wheat and all crops, the correlation co-efficient between farm size and inputs use in different villages were negative.

ii) But for paddy and wheat, the relationship between farm size and fertilizer use was positive and significant.

iii) In case of other crops, the villages with higher farm size used more of human labour and fertilizer.
Ayal Kimhi examined the relationship between land size and maize productivity in Zambia. It was an empirical study based on the agricultural output for the crop year 1993-94 collected by the Central Statistical Office, Zambia. There were 6,00,000 and 1,00,000 small and medium scale farmers in Zambia. The selected samples were designed to be representative for Zambia as a whole.

5329 farm households were selected as a representative of small and medium farms of Zambia. The large commercial farms were not included in the survey because they comprised only 1500 households throughout the nation. Forecast and post-harvest surveys were conducted among the samples.

They also considered other quantitative variables like credit, fertilizers, drought animals, machines, family and hired labour, gender, age and education in order to ascertain their effects on productivity.

They concluded that if plot size is considered as an exogenous explanatory variable, a positive relationship between farm size and yield of maize was recorded. This indicated that economies of scale was dominant throughout the plot size distribution and after accounting for the endogeneity of plot size, they experienced an inverse relationship between farm size and productivity in all plots up to three hectares.

Atanu Sengupta and Subrata Kundu considered the cultivation of different crops in the Midnapur district of West Bengal – a state where large scale land reforms took place and varied socio-economic and geographical
features prevailed. The data collected by the Ministry of Agriculture, Government of West Bengal through the cost of cultivation scheme was used.

A multi-stage random sampling design was used from blocks to mouza and mouza to households so as to select the samples. The study covers the period of 1999-2000.

The study included a sample of 165 farmers and only 3 inputs namely, human labour hour, bullock hour and fertilizer for estimating the efficiency. The advanced and backward areas were distinguished on the basis of the agricultural development index which considered (i) the average composite yield per unit area, (ii) average productivity of labour, (iii) available irrigation facilities, iv) use of chemical fertilizers; and v) degree of mechanization.

Data Envelopment Analysis (DEA) was used to study the performance of farmers. They concluded that the negative relationship in West Bengal's agriculture is a manifestation of government policies that have prevented the market forces from operating to its full.

II. Studies on Factors Influencing Agricultural Productivity

Land, being a basic factor of production, possess some inherent and in-destructible powers. But, land as a single factor can not produce by itself. It must be combined with other factors so as to be productive. Carter observed that while land quality explains some of the inverse relationship, it
does not explain all of it. So, it becomes necessary to find out other factors that determine the agricultural productivity.

Kalirajan\textsuperscript{89} noted that the extension worker's limited contact with the farmers and farmer's mis-understanding of the technology were responsible for the difference between the actual and maximum yields among the farms. So he stressed that the policy makers must focus on extension work\textsuperscript{90} in order to increase rice production and reduce in-efficiency.

Weirs\textsuperscript{91} identified four years of primary schooling as a basic requirement to have a significant effect upon farm productivity.

Fan, et al.,\textsuperscript{92} added that investments in road, electricity and education have multiplier effect in terms of raising factor productivity in agriculture and giving decent returns per rupee of investment.

In the words of Datta and Dayal,\textsuperscript{93} "The availability of good quality irrigation water coupled with flexibility of irrigation and drainage system and appropriate methods of application as well as pricing of irrigation water would be crucial for sustainable use of land and water resources. The sustainability of irrigated agriculture in the arid and semi-arid regions of the country is faced with the challenge of alkalinity and salinity problems as indiscriminate use of poor quality water in the absence of proper soil-water crop management practices. This poses grave risks to soil health and environment, while affecting the crop yields and returns at the same time".
Hague\textsuperscript{94} opined that restrictions imposed on land leasing practices in some states make the land owners to keep their land fallow or leads to the growth of informal tenancies which ultimately results in in-efficiency.

Environmental aspects also play a dominant role in determining farm efficiency. Hague\textsuperscript{95} opined that low irrigation charges encourage the farmers not to bother about the water use efficiency and this leads to a danger of rapid depletion of ground water. The fertile land also loses its fertility if it is not combined with water supply. Provision of free or subsidised power supply for irrigation causes over exploitation of ground water in many states he added\textsuperscript{96}.

Besley and Burgess\textsuperscript{97} explored the possible connection between the land distribution and productivity in India. They found that land reforms in India were associated with lower poverty and higher agricultural wages. But this occurred through the changes in production relationships rather than through changes in land distribution.

They also found that land reforms had their greatest effect in those Indian states where the greatest initial land in-equality prevailed.

Dietrich Vollrath\textsuperscript{98} quantified the effect of the land distribution on cross-country agricultural productivity by using data on the distribution of operational farm size in countries calculated by Deininger and Squire (1988). The data obtained from the decennial censuses of the Food And Agriculture
Organisation of the UN was used to compute Gini co-efficients for the size distribution of land holdings in countries. The dataset consist of 286 observations across 117 countries ranging in time from 1939 to 1994.

The study showed a significant negative relationship between land in-equality and productivity per acre. It implies heterogeneity in productivity by farm size. This effect persists even after controlling for input use, land quality, human capital, institutions and agricultural research effort.

He also opined that the existence of productivity effect suggests that the distribution of land within countries is not optimal and the land markets are not functioning properly.

III. Studies on Technical and Allocative Efficiencies

Pudasaini\textsuperscript{99} analysed the effects of schooling or the level of education of a farmer in agricultural efficiency in Nepal and came to the conclusion that education contributed to agricultural production in Nepal by enhancing farmer's decision making ability and allocative ability. It also enables them to select improved inputs and optimally allocate existing and new inputs among competing uses.

Kalirajan and Shand\textsuperscript{100} conducted a quantitative analysis of various types of education in relation to productivity among Tamil Nadu rice farmers in order to determine whether schooling of farmers had a greater influence on yield than non-formal education.
The results showed that schooling of farmers had an independent effect on yield but it was not significant. But farmer's non-formal education was found to have a significant and greater influence on yield. They also concluded that farmer’s schooling and productive capacity need not be significantly related under all circumstances.

Parikh and Shah\textsuperscript{101} measured technical efficiency in the North-West Frontier Province of Pakistan by using a translog frontier production function on the cross-sectional data from 397 farms during 1988-89 cropping season. It was found that the average technical efficiency as 96.2%. Lack of education, restricted credit and fragmented holdings were found to be the causes of inefficiency. He recommended the provision of credit and education so as to enhance the efficiency in agriculture.

Adesina and Djato\textsuperscript{102} investigated the extent to which education influences efficiency in agriculture using a sample of 410 rice farmers in Northern Cote d'Ivoire by employing multiple regression model. They found that there is no difference in both relative, technical, allocative or economic efficiencies between educated (1 year of schooling) and non-educated farmers.

The conclusion was that educated farmers are not more efficient than non-educated farmers because the latter may have an empirical knowledge obtained from cumulative farming experience.

Byiringiro and Reardon\textsuperscript{103} analysed the effects of farm size, soil erosion and soil conservation investments on land and labour productivity
and allocative efficiency in Rwanda. They found that small Rwandan farms achieve 3 times greater land yields, use 4 times more labour and have 4 times the number of plots per hectare than larger farms do. So, there exists a strong inverse relationship between farm size and land productivity. They also found that small farms have greater average and marginal productivity of land and are in-efficient in resource allocation because of factor market access constraints.

Tadesse and Krishnamoorthy\textsuperscript{104} analysed the technical efficiency of paddy farms of Tamil Nadu in the light of ecological impact of sustainable agricultural production. Their conclusions are given below.

(i) 90\% of the variation in output of IR-20 paddy farms in Tamil Nadu was due to differences in technical efficiency.

(ii) The mean technical efficiency was 83\%.

(iii) It is recommended that small farmers should follow more efficient use of resources and extension services.

Owens et al.,\textsuperscript{105} investigated the impact of farmer contact with agricultural extension services on farm productivity using panel data obtained during the period 1993-1997 in Zimbabwe. The data were drawn from a sample of households re-settled in 3 regions in Zimbabwe. They found that access to agricultural extension services (at least one or two visits to the field by extension officers per agricultural year) raised the value of crop production
by 15%. They also showed that the impact of agricultural extension services differed among individual crops and among years.

Ajibefun and Daramola\textsuperscript{106} listed out the impact of different factors on the efficiency of micro enterprises in the Nigerian economy. They concluded that education is an important variable that determines farm efficiency and so it could be used by policy makers to improve both technical and allocative efficiency.

Ogundele and Okoruwa\textsuperscript{107} made a comparative study of traditional and improved rice variety farmer's technical efficiency in Nigeria by using frontier analysis. They proved that farm size significantly determines the level of technical efficiency in Nigeria. They computed the average technical efficiency for each rice farm group at 90%. Labour input, herbicides, seeds, levels of education and farming experience are the other factors which cause efficiency.

Thomas Masterson\textsuperscript{108} analysed productivity, technical efficiency and farm size in Paraguayan agriculture by using 2000-2001 MECOVI data set and the soil quality data obtained from the Ministry of Agriculture. It included data on a sample of 8131 representative Paraguayan households.

His study focused on two measures and they were (i) land productivity and (ii) technical efficiency. Land productivity was measured by dividing the aggregate output by farm size. Technical efficiency was measured by two measures. (i) non-parametric technique - data envelopment
analysis; and (ii) Regression technique – a stochastic production frontier approach.

He concluded that (i) land productivity measure clearly shows a tendency to decrease with farm size, (ii) The impact of tenure security decreased land productivity and technical efficiency, (iii) Rising shares of household labour employed in agriculture resulted in lower productivity and efficiency because the share of family labour to total labour is too low and while better farmers opt to hire themselves out rather than working on their farm, (iv) There is no evidence to prove that there are significant productivity or efficiency differences between men and women; and (v) Land productivity rises slightly if the size of farm is too large.

Seidu-Al-Hassan\textsuperscript{109} analysed the technical efficiency of rice farmers in Northern Ghana in order to examine the level of technical efficiency between irrigated and non-irrigated rice farmers and to derive farm specific technical efficiency associated with input used.

The period of study was 2005-06 cropping season. The total sample consisted of 732 (252 irrigators and 480 non-irrigators) rice farmers from 11 districts among the three regions. The technical efficiency was measured by means of stochastic production frontier method.

The findings are that rice farmers (irrigators and non-irrigators) are technically inefficient. The mean technical efficiencies for irrigators, non-irrigators and sample farms are 51\%, 53\% and 53\% respectively. Because, the
irrigation schemes in the study area are old and they are characterised by poor water control and lack of maintenance. The level of farmer's education and extension contact significantly determine technical efficiency in irrigated rice farming and that of the non-irrigated rice farming is significantly determined by the farmer's age, family size, the level of farmers education and extension contact.

IV. Studies on Relative Efficiency of Peasant and Tenant Farms

Agriculture in most of the countries is carried on not only on the own land holdings but the hired-in holdings also. Therefore, two categories of farmers have emerged. (i) peasant farmers – who owned the land holding and engaged in agricultural operations; and (ii) Tenant farmers – who leased-in farms from the land owners for rent and perform agricultural operations.

The theories pertaining to the effectiveness of these two types of farmers are given under.

Adam Smith\textsuperscript{110} quoted that the tenants are least interested in the further improvement of land because the landlords taken away the major share of the total produce without sharing the cost of production. Rent is not in proportion to the amount spent by the landlord for the improvement of land or to what he can afford to take; but what the farmer can afford to give. Therefore, the landlords squeeze the tenant to the maximum and the tenant has no little of total produce despite his un-tiring intensive efforts to increase productivity.
Alfred Marshall\textsuperscript{111} opined that the fruits of tenant's investments on land shall accrue largely to the landlord than to himself. So, they are less induced to invest in their leased-in land under cultivation.

So, both classicals and neo-classicals argue that tenant farmers are relatively less efficient than owner cultivators because the proprietary rights make the peasant farmer to use the intensive use of land and other resources that ultimately increase agricultural production.

Johnson\textsuperscript{112} is of the view that insecurity of tenure discourages investment because of doubt about future profits and so reduces efficiency in share cropping lease arrangements.

Charles Isswaï\textsuperscript{113} on the basis of experience from Japan viewed that fixed rent arrangement has a favourable effect on productivity in contrast to share cropping which inhibits productivity and investment as well.

Sen\textsuperscript{114} questioned whether the gross or net output to be shared between landlord and tenant.

Cheung's\textsuperscript{115} theoretical formulation and empirical analysis conclude that resource allocation under fixed rent and share cropping contracts will be identical. So, he concluded there will be parity among all systems of farming whether peasant farming, share cropping tenancy or fixed rent tenancy. Bardhan and Srinivasan,\textsuperscript{116} Newberry\textsuperscript{117} and Hsiao\textsuperscript{118} are also having the same view of Cheung.
Krishna Bharadwaj viewed that the land owners wish to provide their land for short term leases for capitalizing the productivity gains by raising fixed rent. This leads to carelessness and mis-use of land by the tenants.

Lipton observed that a secured tenant agriculturist without share cropping and with adequate access to credit is much un-equal, less exploitative and less inefficient than existing share cropping system.

The studies that testify the validity of Marshall versus Cheung’s views in the Indian context in the post green revolution periods are many. The results of these studies are mixed.

Vyas made a comparative study of tenant farms and cultivators of own farms in four villages of Gujarat in 1950’s to find their relative efficiencies and concluded that tenancy is not in-efficient. He asserts that the tenant farm operators are also efficient if they are given adequate credit and extension services.

Rao by making a comparative study between pure owners and share-croppers in rice growing parts of Andhra Pradesh by using SEFM data for the years 1957-58 and 1958-59 concluded that there is no significant inefficiency in the use of land under share-cropping. Dwivedi and Rudra also substantiated the conclusion of Rao.
Chakravarthy and Rudra's\textsuperscript{124} analysis confirmed that tenant farmers have relatively a poorer economic performance than the owner cultivators.

Parthasarathy and Prasad\textsuperscript{125} made a micro-level study in the West Godavari district in Andhra Pradesh and revealed that there is no apparent difference between share-croppers and owners in terms of output per acre.

Bharadwaj\textsuperscript{126} in her study based on SEFM data for Ahmed Nagar and Nasik districts confirmed the inverse relationship between the increasing degree of tenancy and the output per acre. Stiglitz's\textsuperscript{127} study endorsed Chenung's views.

Nadkarni\textsuperscript{128} analysed the socio-economic conditions of tenants and landlords in six villages of Marathvada and concluded that the socio-economic position of the landlords are relatively better than the tenants because of the appropriation of higher rent. He also ascertained that the small land owners are interested in leasing out their lands to large owners and willing to work in the latter's farms in order to secure loans when needed.

Clive Bell's\textsuperscript{129} study for Purnea district in Bihar found significantly higher inputs and output per acre on owner land relative to share-cropped land.
The study by Chattopadhyay\textsuperscript{130} showed a greater difference between owner and tenant cultivated farms with regard to their yield performances.

Sen's\textsuperscript{131} study based on SEFM data relating to Punjab and West Bengal showed that a strong dis-incentive effect is associated with share-cropping.

Bliss ad Stern\textsuperscript{132} in their study on Palannpur village in Uttar Pradesh for the period 1974-75 concluded that there is no significant relationship between tenancy status and wheat yields.
References


90. A Method by which Information of New Technologies, Better Farming Practices and Better Management can be Transmitted to Farmers.


