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Farm Profitability and Efficiency in Paddy Production on Small Scale Farming in Punjab

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Abstract

The present study undertaken in Punjab state, has estimated the cost and return structure and technical efficiency in paddy production. Technical efficiency of individual farm has been estimated using stochastic production function. A sample of 280 farmers consisting of 121 marginal and 159 small farmers was selected from the state. The per hectare cost of cultivation and gross returns were recorded to be Rs, 70444 and Rs. 1.13 lakh on marginal farms and Rs, 65144 and Rs, 1.10 lakh on small farms. The study revealed the mean technical efficiency of 90.94 per cent in Punjab state as whole. The education was the most influential determinant positively influencing the technical efficiency and number of farm workers negatively influenced the efficiency of paddy in the state. To reduce inefficiency in the production of paddy measures like improving the literacy rate, strengthening extension services and providing alternate employment opportunities should be taken up in the study area.

Keywords: Small scale farming, Cost of cultivation, Technical efficiency, Stochastic frontier, Production function

JEL Classification: Q12, Q14, Q16

Introduction

The agriculture in India is characterized by dominance of small and marginal farms. These farmers having the poor resource base are prevented from acquisition and adoption of modern technologies which are capital intensive, thus making farming a non-profitable activity for these smallholders (Saikia and Goswami, 1992).The agricultural and rural development in India has passed through a policy design revolving around the food security of the country and of the individual households (Bhalla and Singh, 1997) and paddy-wheat in this context has assumed greater significance. Rice is a staple food crop and it constitutes over half of the cereals consumption of the country (Bharati *et al,* 2014; Ali, 2008; Chaudhary and Harrington, 1993). The total domestic demand for rice is estimated to be 113.3 million tonnes and requires 28-29 per cent yield enhancement to achieve 2.65 tonnes per hectare average yield for the year 2022-23 (Kumar and Singh, 2019; Sekhon et al, 2010). This succinctly delivers divisibility of rice, not only as the most important food crop but also as an intricate part of socio-cultural aspects of the lives of many people in the major rice producing regions of the world (Job and Nandamohan, 2004).

Punjab was already known for wheat but rice was an inconsequential crop to begin with. The area under rice was 3.90 lakh ha in 1970-71 and went up to 3.04 million hectare in 2016-17. The intensive agricultural practices associated with the rice-wheat system in the state of Punjab are posing a threat to its very sustainability. Excessive use of resources leading to increase in the cost of cultivation on one hand and stagnating land productivity on the other, have rendered such practices both economically and environmentally unsustainable. Agriculture in Punjab had high growth for a long time up to early 1990s; it slowed down thereafter due to the available potential of resources and technology getting exploited closer to the possible limits, which led to

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increasing costs, shrinking resource base, declining productivity, profitability and incomes (Kalkat *et al,* 2006; Singh, 2009).

The growing population enhances the demand for agricultural products and as there is no scope left for expanding land frontiers with increasing trend of diversion of cultivable land for non agricultural purposes (Deshpande and Bhende, 2003), therefore only way to increase the paddy production is through adoption of improved technologies and efficient use of available resources in paddy cultivation. The productivity growth can be achieved by improvement in technical efficiency. The increase in technical efficiency opens up the prospect for farmers to increase output using the same level of resources (Beltran and Reig, 2014). Improving technical efficiency is important to reap the potential benefits of the existing technology, rather than searching for new technology (Kalirajan *et al,* 1996). Studies by Umesh and Bisaliah (1991) and Shanmugam (2002) have indicated that it is possible to raise the productivity of crops without raising the input application.

The present study, therefore, was an attempt to study, the cost and return structure of paddy crop in different zones of Punjab so as to explore possibilities of lowering cost of cultivation to meet the objective of protecting consumers' interests. The study would help in identifying the levels of efficiency and also in formulating the policy to improve the efficiency of the paddy growing farmers in Punjab.

Data Sources and Methodology

The data related to the study were taken from the sponsored scheme, "A study into the economics of farming and the pattern of income and expenditure distribution in the Punjab agriculture" operating in the Department of Economics and Sociology, Punjab Agricultural University, Ludhiana for the year 2014-15, 2015-16 and 2016-17. Four blocks from Sub-Mountainous zone, fourteen blocks from Central zone and three blocks from South-Western zone were selected randomly at the first stage of sampling and one village from each block was selected at the second stage. Thus twenty one villages were selected from the Punjab state. The sample of thirty one marginal and thirty small families was selected from Sub-Mountainous zone (Zone-I), eighty marginal and one hundred fifteen small farm families from Central zone (Zone-II) and ten marginal and fourteen small farm families were selected from South-Western zone (Zone-III). Thus the sample of 121 marginal and 159 small farm households was selected randomly. The overall sample consisted of 280 farm families in the study.

The different farm management concepts defined by Commission on Agricultural Costs and Prices (CACP) were used in the present study. Cost A_1, includes the cost of different inputs, depreciation on fixed capital and interest on working capital. Cost A_2 was obtained by adding rent paid for leased-in-land to cost A_1. One more concepts of cost of production were used in the study, viz. cost C_2, which is sum of rental value of owned and leased in land and cost B_2 imputed value of family labour.

Technical efficiency of the individual farm was estimated through stochastic frontier production function analysis. The specific stochastic frontier production function model estimated was

$$LnY_i = \beta_o + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 + \beta_5 lnX_5 + \beta_6 lnX_6 + \beta_7 lnX_7 + (V_i - U_i)$$

Where

Ln = Natural logarithm

Y_i = Gross income from crops of i-th farm/ha, $\beta_o \ldots \beta_7$ = Parameters to be estimated,

X_1 = Family Labour (Hr/ha), X_2 = Hired Labour (Hr/ha), X_3 = Machine Labour (Hr/ha)

X_4 = Irrigation (Rs/ha), X_5 = Seed (kg/ha), X_6 = Fertilizer (kg/ha), X_7 = Plant protection chemicals (Rs/ha), V_i = Random error having zero means which is associated with random factors which are not under control of the farmer. U_i = One sided inefficiency component.

This type of stochastic frontier was independently proposed by Aigner *et al* (1977) and Meeusen and Broeck (1977). The symmetric component V_i accounts for random variations in output, i.e. due to factors outside the farmer's control such as weather and occurrence of pest and diseases. It is assumed to be independent and identical as N $(0, \sigma_v^2)$. A one-sided component that captures deviations from the frontier due to inefficiency (Ui> 0) is assumed to be non-negative of the N $(0, \sigma_u^2)$ distribution (half normal distribution) or has exponential distribution.

$$\varepsilon_i = V_i - U_i$$

The variance of ε_i is given by $\sigma^2 = \sigma_u^2 + \sigma_v^2$

where, the term σ^2 is the variance parameter that denotes the total deviation from the frontier, σ_u^2 is the deviation from the frontier due to inefficiency, and σ_v^2 is the deviation from the frontier due to stochastic noise.

$\gamma = \sigma_u^2 / (\sigma_u^2 + \sigma_v^2)$

where, γ is an indicator of relative variability of Ui and Vi that differentiates the actual yield from the frontier. When σ_v^2 tends to zero, it implies that Ui is the predominant error, then $\gamma = 1$. This means yield difference is mainly due to non-adoption of best practice or technique. When σ_u^2 tends to zero, it implies that the symmetric error-term, Vi is the predominant error and γ will be tending to zero. This means that yield differences from the frontier yield is mainly due to either statistical error or external factors that are not included in the model.

The technical inefficiency effect, U_i is defined as:

$U_i = \delta_0 + \delta_j Z_i + W_i$

Where;

Z_1 = Farm size (acres) Z_2 = Age of the farmer (years)
Z_3 = Family size (No.)
Z_4 = Education of the farmer (years in school),
Z_5 = Number of family members working on farm,
Z_6 = Experience in agriculture (years)

Results and Discussions

Socio-Economic profile of the sample farmers

The size of operational holding of sample marginal and small farm households was 0.74 ha and 1.56 ha respectively. The family-size increased with the increase in size of farm indicating a positive correlation between the two variables. The average family size of the marginal farmer was lower than that of small farmer in all the agro climatic zones of Punjab except sub-mountainous zone. The average age of the marginal farmer was higher as compared to small farmer in overall Punjab and central zone whereas small farmers of sub-mountainous and south-western zone had higher age as compared to marginal farmers. As far as education level is concerned, the small farmers were found to have better educational level as compared to marginal farmers in all the zones as well as overall Punjab. Marginal farms made higher farm investment as compared to small farms. A direct relationship was found between machinery use and the farm size indicating thereby that a higher use of machinery took place on higher categories of farms in the state (Table 1).

Table 1. Important socio-economic characteristic of marginal and small farm households

Zone	I		II		III		Overall	
Particulars	**Marginal**	**Small**	**Marginal**	**Small**	**Marginal**	**Small**	**Marginal**	**Small**
Average operational holding (Ha)	0.63	1.39	0.78	1.56	0.73	1.87	0.74	1.56
Average family size (No.)	5.06	5.00	4.48	4.90	5.10	6.21	4.68	5.03
Age (Yrs)	44.03	44.27	49.91	48.28	41.50	46.14	47.71	47.33
Education level (Yrs)	6.97	6.93	6.20	7.16	5.50	6.36	6.34	7.04
Total farm investment (Rs/farm)	86451.61	163060.5	244751.9	403007.2	167759	303553.9	197832.6	349602.8
Tractors (No.)	1 (3.23)	1 (3.23)	18 (22.50)	65 (56.52)	1 (10.00)	7 (50.00)	20 (16.53)	73 (45.91)
Electric motor (No.)	5 (16.13)	12 (40.00)	64 (80.00)	115 (100.00)	1 (10.00)	8 (57.14)	70 (57.85)	135 (84.91)
Diesel engine (No.)	5 (16.13)	6 (20.00)	53 (66.25)	85 (73.91)	7 (70.0)	10 (71.43)	65 (53.72)	101 (63.52)

Note: Figure in the parentheses indicate percentages to the total

The studies on cost of cultivation of agricultural commodities are required by the researchers and policy-makers for devising strategies for planned agricultural development and are useful to organizations working closely to the agricultural sector while the region specific information is considered to be the key parameter for addressing the micro level issues of the economy**.** Keeping in view the above stated issues, zone wise cost of cultivation of paddy crops grown in Punjab was undertaken in the study. The per hectare cost of cultivation of paddy in the Punjab state as the whole was higher (Rs.70444) on marginal farms as compared to small farms (Rs. 65144). The share of variable and fixed cost in the total cost was 37 and 63 per cent on marginal farms and on small farms, respectively (Table 2). The major proportion of variable cost was dominated by human labour followed by machine labour. The study by Kumar *et al,* 2013 also reported that the expenditure incurred on the human labour was the maximum in paddy cultivation as the human labour both casual and family labour was used for performing the operation like transplanting, weeding and harvesting in paddy crop. Machine labour component had the second highest contribution after the human labour because the farmers were dependent on the hiring of machines for various farm operations i.e. with the growing diffusion of technology in paddy, there has been widespread mechanization of almost all farming operations.

The third largest component, after wages, in the operational costs of cultivation was fertilizer charges and there is a tendency among farmers to boost the application of chemical fertilizers, without minding the accompanying problems like weeds, pests and nematodes, which require the application of pesticides and weedicides. Therefore farmers using high doses of chemical fertilizers have to incur large expenses on insecticides, weedicides and herbicides (Raghavan, 2008). Fixed costs had more impact in total cost as compared to total variable cost in case of paddy crop.

The zone wise analysis reveals that per hectare cost of paddy cultivatiom was lowest in zone-I and highest in zone-II for both the farm categories. The higher cost in zone-II may be attributed to the high rental value of owned land as productivity of land in zone-II is higher compared to that in zone-I and zone-III. Moreover, the use of human labour was also quite high in zone-II and zone-III as compared to that in zone-I.

The gross returns per hectare of marginal farmers was recorded to be highest in zone-III followed by zone-II and zone-I, whereas in case of small farmers, the study recorded highest gross returns per hectare in zone-I, followed by zone-II and zone-III. Returns over cost C_2 which is also called profit level and net return is obtained after paying all the cost of cultivation was highest in zone-I (Rs. 47333 per ha) and the lowest in zone-II (Rs. 40378 per ha) for marginal category, whereas in the small category it was recorded to be highest in zone-I (Rs. 50979 per ha) and lowest in zone-II (Rs. 36880 per ha) (Table 3).

Technical efficiency in paddy farms

Technical efficiency was estimated by fitting a frontier production function. Man hours of human, hired and machine labour, seed, irrigation, fertilizer and plant protection chemical were used as input variables in the estimation of parameters.

Frontier production function

The estimated coefficients of frontier production function are given in table 4. The maximum likelihood estimates of production function for the Punjab state as a whole revealed that the output elasticity with respect to plant protection chemical was positive (0.059) and was highly significant at 1 per cent, indicating it to be the most productive input for crop production. The coefficient of family labour was negative (-0.071) and significant, indicating overuse of the factor in producing the paddy crop. Easy availability of human labour especially family labour may be the reason for using higher doses of human labour than required (Reddy and Sen 2004). Fertilizer nutrients and machine labour were positively and significantly contributing towards the paddy crop production on both marginal and small farms, while irrigation was negatively influencing the paddy production on marginal farms. Statistically significant and positive values of the estimated coefficients indicated that farmers could increase per hectare yield by applying more units of these inputs.

The estimated value of γ was 0.888 in overall Punjab which indicates the presence of significant inefficiencies in the production of the paddy crop. In other words, about 88 per cent of the difference between the observed and the frontier output was mainly due to the inefficient use of resources, which are under the control of the sample farmers. These findings corroborate the observations made by Battese and Coelli

Table 2. Cost structure of paddy cultivation on marginal and small farms in Punjab

(Rs/ha)

Zone	I		II		III		Overall	
Particulars	**Marginal**	**Small**	**Marginal**	**Small**	**Marginal**	**Small**	**Marginal**	**Small**
Variable Cost								
Seed	764.90 (1.33)	854.33 (1.34)	864.96 (1.18)	925.65 (1.26)	823.33 (1.17)	802.75 (1.24)	857.16 (1.22)	914.74 (1.40)
Fertilizer	3514.09 (6.10)	4484.36 (7.01)	3309.90 (4.52)	2882.94 (3.92)	2249.76 (3.18)	1777.31 (2.74)	3312.83 (4.70)	2867.05 (4.40)
Plant Protection	3452.20 (6.00)	3865.47 (6.04)	3048.09 (4.16)	2775.24 (3.77)	5969.17 (8.45)	4174.30 (6.43)	2945.22 (4.18)	2773.20 (4.26)
Human labour	8390.03 (14.57)	8701.30 (13.60)	10893.39 (14.87)	9723.74 (13.22)	10034.38 (14.20)	9202.96 (14.18)	10700.21 (15.19)	9626.89 (14.78)
Machine Use	5167.88 (8.98)	6270.31 (9.80)	6493.58 (8.86)	6039.70 (8.21)	5145.83 (7.28)	6235.07 (9.61)	6381.16 (9.06)	6014.74 (9.23)
Irrigation charges	1349.74 (2.34)	1310.55 (2.05)	1281.05 (1.75)	1074.20 (1.46)	1698.13 (2.40)	1307.34 (2.02)	1290.81 (1.83)	1080.21 (1.66)
Interest on working capital*	611.39 (1.06)	679.88 (1.06)	752.64 (1.03)	676.81 (0.92)	772.14 (1.09)	686.48 (1.06)	742.51 (1.05)	673.13 (1.03)
Total variable cost	**23250.24**	**26166.20**	**26643.60**	**24098.28**	**26692.73**	**24186.20**	**26229.91**	**23949.96**
TVC % of TC	(40.38)	(40.90)	(36.37)	(32.76)	(37.78)	(37.28)	(37.24)	(36.76)
Fixed cost								
Depreciation	3031.64 (5.27)	2697.81 (4.22)	9332.01 (12.74)	7962.30 (10.82)	5843.29 (8.27)	5708.56 (8.80)	7670.81 (10.89)	6842.30 (10.50)
Interest on Fixed capital	911.89 (1.58)	980.83 (1.53)	4303.70 (5.88)	4013.08 (5.46)	2366.60 (3.35)	2638.03 (4.07)	3404.58 (4.83)	3361.14 (5.16)
Rental value of owned land	30386.43 (52.77)	34138.37 (53.36)	32974.19 (45.01)	37488.70 (50.96)	35753.99 (50.60)	32345.90 (49.86)	33138.54 (47.04)	30990.99 (47.57)
Total Fixed cost	**34329.96**	**37817.01**	**46609.91**	**49464.08**	**43963.88**	**40692.50**	**44213.93**	**41194.43**
TFC % of TC	(59.62)	(59.10)	(63.63)	(67.24)	(62.22)	(62.72)	(62.76)	(63.24)
Total Cost	**57580.20** (100.00)	**63983.22** (100.00)	**73253.50** (100.00)	**73562.36** (100.00)	**70656.61** (100.00)	**64878.70** (100.00)	**70443.84** (100.00)	**65144.40** (100.00)

*Note: Figures in parentheses are percentages of total; *calculated at the rate of 7 percent per annum for half of the crop period*

(1995), Datta and Joshi (1992), Jayaram *et al* (1992) and Rama Rao *et al* (2003). Further, the significance of gamma indicates that the assumption of the half normal distribution for u is valid for the present data set (Kalirajan and Shand, 1989). The values of gamma was 96 per cent and 85.70 per cent on marginal and small farms, respectively.

The data given in table 5 showed the factors affecting technical efficiency by farm size class as well as for the sample as a whole. The technical inefficiency reduced significantly with the increase in the level of education on small farms as well as the state as whole. The coefficient between education and technical inefficiency was also negative and significant which suggests that as education level of the farmers improves, the inefficiency decreases, i.e. efficiency improves. This result was similar with most empirical findings (Abdulahi and Eberlin, 2001; Amaza *et al,* 2006; Biswajit *et al,* 2012.) Education enhances the ability of farmers to see, decipher and make good use of information about production inputs, thus leading to the efficient use of resources at the disposal of the farmer. Education also improves the capacity of the farmer to understand and take up improved technology that would shift his or her production frontier upwards (Ahmed *et al,* 2013). The well-educated farmers can

Table 3. Cost and return structure of paddy crop based on various cost concepts on marginal and small farms in Punjab (Rs/ha)

Zone	I		II		III		Overall	
Particulars	Marginal	Small	Marginal	Small	Marginal	Small	Marginal	Small
Cost A1	23371.66	25186.26	31588.55	27976.53	28676.65	26008.73	29627.86	26747.73
Cost A2	23688.18	25186.26	32231.76	29568.48	32675.98	28440.75	30514.92	27952.87
Cost C2	57580.20	63983.22	73253.50	73562.36	70656.61	64878.70	70443.84	65144.40
Gross returns (GR)	104912.85	114962.52	113631.54	110442.49	116398.75	103535.66	113024.10	110344.61
Return over cost A1	81541.19	89776.26	82042.99	82465.96	87722.10	77526.94	83396.24	83596.88
Return over cost A2	81224.67	89776.26	81399.78	80874.01	83722.77	75094.91	82509.18	82391.74
Return over cost C2	47332.65	50979.30	40378.04	36880.13	45742.14	38656.96	42580.26	45200.21

understand production technology better and can maintain relationship with extension agencies giving an edge over the illiterate farmer thereby reducing their inefficiency to a great extent. Number of family members working on farm had a negative and significant relationship with technical efficiency on small farms and in overall state, indicating that households with higher number of members working on farm are relatively less efficient in raising the paddy crop. This may be due to the fact that farmers are already using excess human labour in paddy cultivation. Alternative employment opportunities for farm labour is very limited therefore human labour utilization increases with increase in the number of farm workers in the family which will tend to increase the inefficiency of the farm (Reddy and Sen, 2004).

On marginal and small farms, farm size, number of family members working on farm, age of the farmers and number of years of experience in agriculture was positively related with efficiency indicating that higher value of these variables, higher would be efficiencies but none of these variables were significant. They were only indicative of the relationship with the efficiency.

Table 4. Maximum likelihood estimates of stochastic frontier production function for paddy crop, Punjab

Farm size category	Marginal Farms		Small Farms		Overall	
Particulars	Coefficient	t value	Coefficient	t value	Coefficient	t value
Constant	11.540***	36.36	11.574***	28.02	11.434***	43.41
Family labour (Hr/ha)	-0.057**	2.61	-0.079***	-4.96	-0.071***	-5.55
Hired Labour (Hr/ha)	0.002	0.34	0.004	1.09	0.002	0.59
Machine Labour (Hr/ha)	0.019	0.77	0.072**	2.38	0.028	1.48
Irrigation (Rs/ha)	-0.090***	-3.02	0.043	1.16	-0.011	-0.48
Seed (Kg/ha)	0.079	1.17	-0.022	-0.24	0.024	0.42
Fertilizer (Kg/ha)	0.077**	2.29	-0.066	-1.52	0.019	0.65
Plant protection chemicals (Rs/ha)	0.047***	2.98	0.062***	4.27	0.059***	5.62
Sigma2	0.165***	4.39	0.016***	5.04	0.018***	6.89
Gamma	0.960***	23.88	0.857***	11.78	0.888***	20.75
Log likelihood	83.31		127.20		199.35	

*Note: ***, ** and * represents statistical significance at 1, 5 and 10 per cent levels, respectively*

Table 5. Technical inefficiency effect in paddy cultivation in Punjab

Farm size category	Marginal		Small		Overall	
Particulars	**Coefficient**	**t value**	**Coefficient**	**t value**	**Coefficient**	**t value**
Constant	0.027	0.45	0.0871**	2.32	0.0628**	2.33
Farm size (acres)	0.009	0.59	- 0.00053	-0.08	0.00401	1.04
Age (yrs)	-0.001	-1.15	0.00041	0.98	0.00014	0.39
Family size (No.)	0.010	1.41	0.00668	1.42	0.00365	0.32
Education (Yrs)	0.003	1.26	-0.00193*	-1.97	-0.00039*	-1.78
Number of family members working on farm	-0.003	-0.18	0.01449**	2.4	0.01412**	2.34
Experience in agriculture	0.001	1.06	-0.00003	-0.07	0.00006	0.18
Mean technical efficiencies (%)	91.21		91.30		90.94	

*Note: ** and * represents statistical significance at 5 and10 per cent levels, respectively*

The average level of technical efficiency for the state is estimated at 91 per cent indicating that the output can be raised by about 10 per cent by following efficient crop management practices without having to increase the level of application of inputs. Mean technical efficiency of 91 per cent was observed for the marginal farms, implying that on an average, the sample marginal farmers tend to realize 91 per cent of their technical abilities. Mean technical efficiency of small farms was recorded to be 91 per cent (Table 5).

The Fig. 1 depicts the distribution of farms based on technical efficiency. It was observed that about six per cent of the farms in Punjab were harvesting less than 80 per cent of the frontier value productivity, 32 per cent of the farmers in Punjab realized 80-90 per cent of the potential value output whereas 62 per cent of the sample farms were operating near to the frontier having more than 90 per cent of the frontier value production.

The analysis revealed that in case of marginal farms, the estimated technical efficiency of individual farm varied between 57 and 99 per cent. The majority of the marginal farmers i.e. about 61 per cent were operating near the potential output i.e. 90-100 per cent of technical efficiency. Technical efficiency of small farms ranged between 64 and 98 per cent. There were 67 per cent of small farmers who were operating near frontier having more than 90 per cent of the technical efficiency. An analysis of technical efficiency indicated that there was considerable scope to improve the value productivity of crops in the existing conditions of input use and

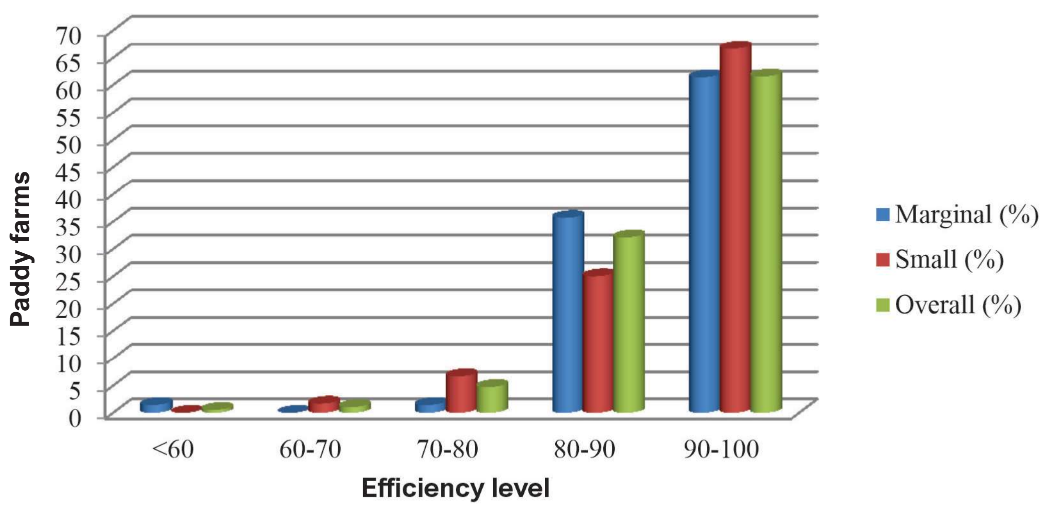

Figure 1. Distribution of the sample paddy farms by level of technical efficiency in Punjab

technology.

Conclusion and Policy Implications

Cost of cultivation of paddy crop in the Punjab state as the whole was higher on marginal farms as compared to small farms. Examination of the cost of cultivation of paddy crop shows that the share of fixed cost in the total cost was more compared to variable cost in case of both categories of farms. The agriculture sector in Punjab is characterized by over-mechanization, resulting in a major increase in the fixed costs of farming thereby turning down profitability. Sky-scraping costs of farm machinery are jeopardizing the economic viability of small and marginal farmers. Therefore it is essential to provide the custom hiring services of various machines to the farmers at right time and at reasonable rates so as to bring down the fixed costs of farm operations.

Improvement in the technical efficiency will lead to maximized output from the given set of inputs. Mean technical efficiency for the state as a whole was 90.94 per cent, implying that 10 per cent of the increase in paddy yield is feasible with a reduction in the input used such as fertilizer, plant protection chemicals and machinery, thereby reducing the cost of cultivation and augmenting the income level of the farmers. Of the various factors affecting the efficiency, number of family members working on farm had shown a negative relationship with efficiency, while education displayed a positive relationship with efficiency. To reduce inefficiency in the production of paddy, measures like improving the literacy rate, strengthening extension services and providing alternate employment opportunities should be taken up in the study area.

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