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Economic analysis of paddy cultivation in Rajnandgaon district of Chhattisgarh, India

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Abstract
The present study is based on economic analysis of paddy production with the objective to work out the cost and returns of paddy in the study area. The present study was conducted in Rajnandgaon district of Chhattisgarh, India. Out of 10 blocks in the district, three blocks namely, Rajnandgaon, Khairagarh and Chhuikhadan, will be selected purposively for the study. Each selected blocks, 2-3 per cent of villages will be selected purposively and the total 300 respondents will be selected purposively for the study. The primary data were collected for year 2017-18. The major findings of this study revealed that on an average the per hectare cost of cultivation of paddy was calculated as Rs. 46295.99, on an average yield of paddy was observed 37.63 quintals and average cost of production per quintal of paddy is (Rs. 1227.39). The input-output ratio of paddy was (1:1.67).

Keywords: Paddy, economic analysis, input wise cost of cultivation, net rupees per rupee of investment, cost concepts, measures of farm profit

Introduction
Rice is the most important human food crop in the world, directly feeding more people than any other crop. India is one of the world's largest producers of rice and brown rice, accounting for 20% of all world rice production. Rice is India's pre-eminent crop, and is the staple food of the people of the eastern and southern parts of the country. India has the largest area under paddy in the world and ranks second in the production after China. The India's rice production reached to a record high during 2018-19 is estimated at record 116.42 million tonnes. Production of rice has increased by 3.66 million tonnes than the production of 112.76 million tonnes during 2017-18. It is also higher by 8.62 million tonnes than the five years' average production of 107.80 million tonnes. Chhattisgarh, known as the rice bowl of the country, had produced 8.04 mt of rice and was among the top three rice-contributing states last year. Paddy is the most important and extensively grown food crop in the World. It is the staple food of more than 60 per cent of the world population. Rice is primarily a high energy calorie food. The straw of paddy is used for packing. Looking to the importance of the crop, it is required to increase the production of paddy and mere attaining the level of food requirement of population is not sufficient because India is already importing pulses and oilseeds from other countries, so we will have to produce that quantity of cereals, which can be exported after meeting the requirement of the domestic population. This will compensate with the cost incurred for the import of other crops and provide strength to Indian economy.

Materials and Methods
Primary data was collected for the year 2017-18. Multi-stage sampling design was adopted for the ultimate selection of paddy growing farmers. The Chhattisgarh state is divided into 3 agro-climatic zones and Rajnandgaon district will be selected purposively. Out of 10 blocks in the district, three blocks namely, Rajnandgaon, Khairagarh and Chhuikhadan, will be selected purposively for the study. Each selected blocks, 2-3 per cent of villages will be selected purposively and the total 300 respondents will be selected purposively for the study. The zone was the first stage, district was the second stage, blocks were the third stage and villages were the fourth stage. Households of farm categories were the ultimate stage. To work out the cost of cultivation standard method of cost of cultivation as per CACP will be adopted which includes cost A, cost B and cost C. These cost concepts and the items of costs included under each concept are given below:

Cost A1
1. Value if hired human labour.
2. Value of hired bullock labour

3. Value of owned bullock labour.
4. Value of owned machinery labour.
5. Hired Machinery Charges.
6. Value of seed (both farm produced and purchase).
7. Value of insecticides and pesticides.
8. Value of manure (owned and purchase)
9. Value of fertilizer.
10. Depreciation on implements and farm buildings.
11. Irrigation charges.
12. Land revenue, cesses and other taxes.
13. Interest on working capital.
14. Miscellaneous expenses (Artisans etc.).

Cost A2: Cost A1 + rent paid for leased in land
Cost B1: Cost A1 + interest on value of owned fixed capital assets (excluding land).
Cost B2: Cost B1 + rental value of owned land (net of land revenue) and rent paid for leased-in land.
Cost C1: Cost B1 + imputed value of family labour
Cost C2: Cost B2 + imputed value of family labour
Cost C2*: Cost C2 adjusted to take into account valuation of human labour at market rate or statutory minimum wage rate whichever is higher.
Cost C3: Cost C2* + value of management input at 10 percent of total cost (C2*).

- **Interest on working capital:** It was calculated @4% per annum for half of the crop period.
- **Interest on fixed capital:** It was calculated @10% per annum for the crop period.
- **Rental value of owned land:** It was calculated based on the prevailing rates in the sampling villages.
- **Depreciation:** It presents the value by which a farm resource decreased in value as a result of cause other than a change in general price of the item. Straight line method was used for calculating the depreciation:

$$\text{Depreciation} = \frac{\text{Purchase value of asset} - \text{junk value}}{\text{No. of useful years of life (expected life)}}$$

Income measures

a. Gross income: It includes the final price of main product and by product of the crop.

b. Net income: Net income = Gross income – Cost C2

c. Family labour income: It is measured on earning of a farmer and his labour and managerial work. It is equal to gross income minus total expenses excluding wage of unpaid family labour.

Family labour income = Gross income - Cost B2

d. Farm business income: It is a measure of earning of farmer and his family for his capital investment, labour and managerial work.

Farm business income = Gross income – Cost A_1

e. Farm investment income: This is the sum of net income, rental value of owned land and interest on fixed capital.

Farm investment income = Farm business income – Imputed value of family labour.

f. Input Output ratio: It is ratio between input and output and computed by dividing value of total output by value of total input.

Input output ratio = O / I
Where,
I = Total input and
O = Total output

Results and Discussion

The productivity and income from the crop production can be judged in better way, if we analyse it with respect to the different costs incurred during cultivation of a particular crop. The cost of cultivation and cost of production of any crop is the most important aspect of the farm economy both at micro and macro level point of views; it provides guideline to the government in promulgating the price policy both for factors of production and the produce. Input wise cost was worked out in two broad heads namely variable cost and fixed cost. The variable cost includes cost of human labour (family and hired), machinery labour, seeds, manures, fertilizers, pesticides, herbicides, and interest on working capital. On the other hand, fixed cost involves land revenues, rental value of owned land and depreciation.

The economics of cultivation of paddy grown in the study area. (Table 1) clearly shows input wise cost of cultivation of paddy per hectare, which is highest in case of large farms (Rs.54838.90/ha) and lowest in case of small farms (Rs.40671.94/ha). Cost of cultivation showed increasing trend from marginal to large farmers. It is due to the fact that large farmers could incur more expenditure on modern farm inputs like quality seed, fertilizers, plant protection chemicals, hired labours etc. The major share of cost among different cost items were found in total labour cost which is 50.30 per cent to the total cost of cultivation out of which 40.37 per cent contribution was of human labour and bullock and machine labour together contribute 9.92 per cent. Total labour cost was increased from marginal to large farms but its contribution in total cost was found maximum in case of small and medium farms which was 51.15 and 51.70, respectively. The average total input cost was found 75.85 per cent, whereas average total fixed cost was 24.15 per cent to the total cost. Rental value of land is highest among fixed costs, which is 22.68 per cent to the total cost of cultivation.

Table 1: Input wise cost of cultivation of paddy at the sampled farm (Rs. /ha.)

S. No.	Particulars	Marginal	Small	Medium	Large	Overall
A	**Input Cost**					
1	Human Labour					
	a) Family	13159.11 (32.35)	12760.75 (28.00)	9263.03 (18.24)	6528.29 (11.90)	11474.62 (24.79)
	b) Hired	1821.37 (4.48)	6088.49 (13.36)	12175.65 (23.97)	15421.16 (28.12)	7216.90 (15.59)
	Total human labour	14980.48 (36.83)	18849.24 (41.36)	21438.68 (42.21)	21949.45 (40.03)	18691.52 (40.37)
2	Bullock and Machinery					
	a) Family	214.25 (0.53)	232.41 (0.51)	124.32 (0.24)	867.35 (1.58)	250.44 (0.54)
	b) Hired	4042.19 (9.94)	4228.02 (9.28)	4697.13 (9.25)	481235 (8.78)	4343.76 (9.38)

	Total Machine and Bullock Labour	4256.44 (10.47)	4460.43 (9.79)	4821.45 (9.49)	5679.70 (10.36)	4594.20 (9.92)
3	Total labour Cost	19236.92 (47.30)	23309.67 (51.15)	26260.13 (51.70)	27629.15 (50.38)	23285.72 (50.30)
4	Seed cost	1421.96 (3.50)	1564.97 (3.43)	1596.16 (3.14)	1932.01 (3.52)	1562.77 (3.38)
5	Manure & Fertilizers	6182.26 (15.20)	6352.82 (13.94)	7917.75 (15.59)	8513.23 (15.52)	6880.13 (14.86)
6	Plant protection	2252.79 (5.54)	2639.35 (5.79)	3155.25 (6.21)	3873.43 (7.06)	2763.54 (5.97)
	Total material cost	9857.01 (24.24)	10557.14 (23.17)	12669.16 (24.94)	14318.67 (26.11)	11206.44 (24.21)
7	Irrigation charges	421.23 (1.04)	468.25 (1.03)	498.02 (0.98)	514.21 (0.94)	466.56 (1.01)
8	Interest on working capital @4%	110.23 (0.27)	145.30 (0.32)	203.04 (0.40)	247.93 (0.45)	158.63 (0.34)
	Sub total	29625.39 (72.84)	34480.36 (75.67)	39630.35 (78.03)	42709.96 (77.88)	35117.35 (75.85)
B	**Fixed Cost**					
9	Land Revenue	10 (0.02)	10 (0.02)	10 (0.02)	10 (0.02)	10.00 (0.02)
10	Interest on Fixed Capital	368.34 (0.91)	368.55 (0.81)	368.91 (0.73)	373.73 (0.68)	369.00 (0.80)
11	Depreciation on implements	168.21 (0.41)	210.21 (0.46)	281.34 (0.55)	1245.21 (2.27)	299.65 (0.65)
12	Rental value of land	10500 (25.82)	10500 (23.04)	10500 (20.67)	10500 (19.15)	10500.00 (22.68)
	Sub total	11046.55 (27.16)	11088.76 (24.33)	11160.25 (21.67)	12128.94 (22.12)	11178.65 (24.15)
C	Total Cost (A+B)	40671.94 (100.00)	45569.12 (100.00)	50790.60 (100.00)	54838.90 (100.00)	46295.99 (100.00)

Note: Figures in the parentheses indicate percentage to the total cost of cultivation.

It is quite evident from table 2 that on an average, the total average cost, value of net income, family labour income and farm business income per hectare came to Rs. 46295.99, Rs. 30852.95, Rs. 42327.57 and Rs 53196.57 respectively from paddy crop. Gross income of the farms by main product and by product together was found to be Rs. 77148.95 per hectare, which was found increasing from marginal to large farms. Whereas, net income was found maximum on marginal farms (31324.06 Rs./ha.) and minimum on medium farms (30081.90 Rs./ha.). Family labour income was found showing decreasing trend from marginal to large farms as contribution of family labour was more on marginal farms and decreased gradually with the increase in farm size. The total average input-output ratio was found 1:1.67 in the cultivation of paddy crop. It is due the fact that increased productivity on small to large farms was the result of extra cost incurred, which decreased the input output ratio. Secondly, family labours do work more efficiently on the farms and marinal farmers were using more family labours as compared to hired labours whereas contribution of family labour found decreasing with the increase in farm size.

Table 2: Yield, cost and return of paddy on the sample farms (Rs./ha)

S. No.	Particulars	Marginal	Small	Medium	Large	Average
1	Total cost (Rs.)	40671.94	45569.12	50790.6	54838.9	46295.99
2	Yield (Qtl)	35.12	37.35	39.45	41.87	37.63
3	Gross return (Rs.)	71996	76567.5	80872.5	85833.5	77148.95
4	Net return (Rs.)	31324.06	30998.38	30081.90	30994.6	30852.95
5	Family labour income	44483.17	43759.13	39344.93	37522.89	42327.57
6	Farm business income	55351.51	54627.68	50213.84	48396.62	53196.57
7	Cost of production (Rs./qtl)	1158.08	1220.06	1287.47	1309.74	1227.39
8	Input-Output ratio	1.77	1.68	1.59	1.57	1.67

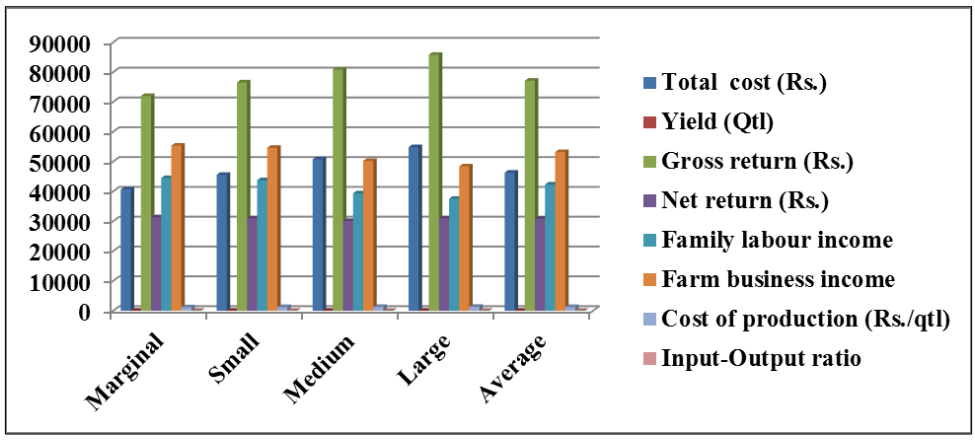

Fig 1: Yield, cost and return of paddy on the sample farms (Rs./ha)

The cost and returns on the basis of cost concept in the production of paddy have been presented in the table 3, which portrays that, on an average cost A1, cost A2, cost B1, cost B2, cost C1,cost C2 and cost C3 were worked out to Rs. 23952.38, Rs. 23952.38, Rs. 24321.38, Rs. 34821.38, Rs. 35795.99, Rs. 46295.99 and Rs.50925.59 per hectare respectively on the sample farms. It was noted that rupees 10500 were considered as imputed rental value of owned land for one crop season. Cost A1 is showing increasing trend from marginal to large sized farms because of more use of hired labour, plant protection chemicals, manure and fertilizers etc. An break-up of cost, cost concept wise income over different average cost A1, cost A2, cost B1, cost B2, cost C1,cost C2 and cost C3 were worked out to Rs. 53196.57, Rs. 53196.57, Rs. 52827.57, Rs. 42327.57, Rs. 41352.96, Rs. 30852.96 and Rs. 26223.36 per hectare respectively on the sample farms.

Table 3: Break-up of cost, cost concept wise income over different cost in paddy at the sample farm (Rs./ha)

S. No.	Particulars	Marginal	Small	Medium	Large	Overall
A.	**Break-up of costs**					
	Cost A1	16644.49	21939.82	30658.66	37436.88	23952.38
	Cost A2	16644.49	21939.82	30658.66	37436.88	23952.38
	Cost B1	17012.83	22308.37	31027.57	37810.61	24321.38
	Cost B2	27512.83	32808.37	41527.57	48310.61	34821.38
	Cost C1	30171.94	35069.12	40290.60	44338.90	35795.99
	Cost C2	40671.94	45569.12	50790.60	54838.90	46295.99
	Cost C3 + 10 %	44739.13	50126.03	55869.66	60322.79	50925.59
B	**Income over different cost**					
	1. Income over cost A1	55351.51	54627.68	50213.84	48396.62	53196.57
	2. Income over cost A2	55351.51	54627.68	50213.84	48396.62	53196.57
	3. Income over cost B1	54983.17	54259.13	49844.93	48022.89	52827.57
	4. Income over cost B2	44483.17	43759.13	39344.93	37522.89	42327.57
	5. Income over cost C1	30171.94	35069.12	40290.60	44338.90	41352.96
	6. Income over cost C2	31324.06	30998.38	30081.90	30994.60	30852.96
	7. Income over cost C3	27256.87	26441.47	25002.84	25510.71	26223.36
C	**Gross income**	71996.00	76567.50	80872.50	85833.50	77148.95
D	**Total cost at C3**	44739.13	50126.03	55869.66	60322.79	50925.59
E	**Input - Output ratio**	1:1.61	1:1.53	1:1.45	1:1.42	1:1.51

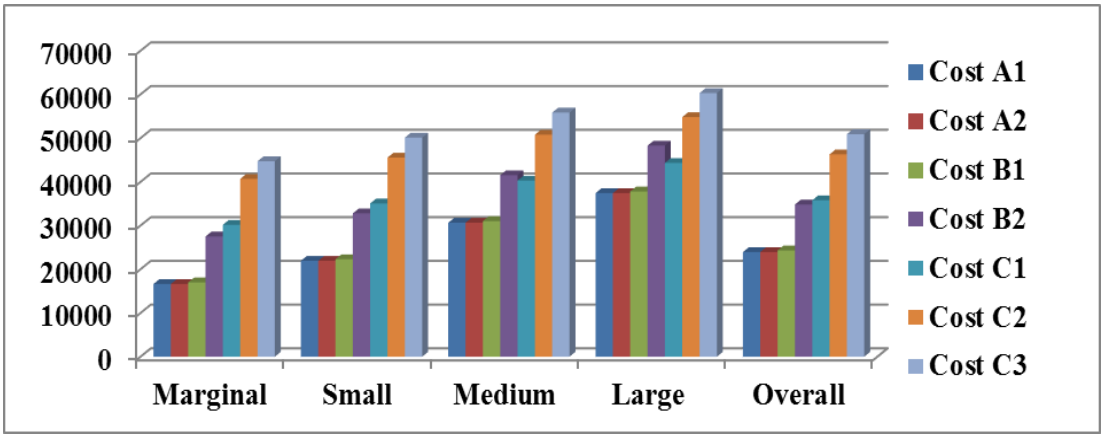

Fig 2: Cost concept wise income over different cost in paddy at the sample farm (Rs./ha).

Summary and Conclusion

The major findings of this study revealed that on an average the per hectare cost of cultivation of paddy was calculated as Rs. 46295.99, on an average yield of paddy was observed 37.63 quintals and average cost of production per quintal of paddy is (Rs. 1227.39). The input-output ratio of paddy was (1:1.67). The cost and returns on the basis of cost concept in the production of paddy on an average cost A1, cost A2, cost B1, cost B2, cost C1, cost C2 and cost C3 were worked out to Rs. 23952.38, Rs. 23952.38, Rs. 24321.38, Rs. 34821.38, Rs. 35795.99, Rs. 46295.99 and Rs.50925.59 per hectare respectively on the sample farms.

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