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Economic analysis of processing of rice mill in Maharashtra

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Abstract

The agro-processing industries place a huge demand on agricultural raw materials. Thus, advancement in agro-processing industries also promotes agricultural development in India. The primary data was collected by personal interviewing processor. Therefore the attempt was done to estimate per unit cost and returns of processing unit. An attempt, also been done to determine the break-even point of agro processing unit and optimum size of value addition in rice. In the light of the empirical evidences brought out from the study, the following result are drawn. In almost all size groups of crops mills, the investment in land constituted the main items of investment followed by machinery and factory building. Per quintal total cost was decrease with increase in size of rice mills. The net return per quintal for paddy processing was found to be higher in case of small mills as compared to medium and large mills. Benefit cost ratio was also found to be higher in medium sized mills. To estimated break – even quantity was increase with the increase in the size of processing mills. Value addition in processing of paddy was higher in medium sized followed large and small rice mills.

Keywords: Paddy, capacity utilization, cost and returns, break-even point, value addition

Introduction

In 2016, world production of paddy rice was 241 million tonnes, led by China and India with a combined 50% of this total and other major producers were Indonesia, Bangladesh and Vietnam. Agriculture and industry have traditionally been viewed as two separate sectors both in terms of their characteristics and their role in economic growth. Agriculture has been considered the hallmark of the first stage of development, while the degree of industrialization has been taken to be the most relevant indicator of a country's progress along the development path. The agro-processing industries place a huge demand on agricultural raw materials. Thus, advancement in agro-processing industries also promotes agricultural development in India. In Maharashtra, specifically in paddy producing district like Bhandara and Gondiya, some agro-processing industries are playing vital role in processing of paddy into rice and contributing into the economy of Maharashtra.

Objectives

1. To estimate per unit cost and returns of rice processing unit.
2. To work out Break- even point of rice processing unit.
3. To study the value addition in rice.

Methodology

The Bhandara and Gondiya district was randomly selected. The data was collected by survey method by conducting personal interviews of processors using specially designed schedules prepared for the purpose. The primary data in respect of cost of processing by processors in production was collected. Small processing unit with a capacity below 1 q/hrs. Medium processing unit with a capacity below 5 q/hrs and large processing unit with a capacity below 15 q/hrs. Ten processing units were selected randomly from the available processing units.

Techniques of Data Analysis

The cost and return of processing unit was worked out by using simple tabular analysis and benefit-cost ratio. The financial test ratio viz. operating ratio, fixed ratio, gross ratio and capital turn-over ratio. The break- even volume of output is determined with the help of following formula.

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$$Q = \frac{TFC}{(P-AVC)}$$

Where,

Q = Quantity of processed rice in quintals required for break-even.

TFC = Total fixed cost

P = Price (Processing charges) per quintal

AVC = Average variable cost of processing per quintal

The difference between price for which a processing industry sold its rice and the cost incurred on the purchased inputs by it.

Value addition = Selling price of the product – Cost of the total inputs.

Result Discussion

The present study was undertaken with a view to workout costs and returns, break-even point and value addition in rice.

Economics of processing and marketing of rice

The capacity and ownership structure plays vital role in processing of rice as it has direct impact on cost and quantity involved in processing of rice. Therefore, an attempt was made to study the ownership structure, capacity utilization and recovery percentages of main and by products in rice processing mills in the study area and presented in Table 1

Table 1: Capacity utilization of rice mills and recovery of rice (May 2015 to April 2016)

Sr. No	Particulars	Size groups		
		Small	Medium	Large
1.	Capacity of rice mill (qtl/day)	13.45	61.75	151.93
2.	No. of mills according to ownership			
	Individual	2	3	2
	Family / Partnership	0	1	2
3.	Number of working days	245	215.00	230.00
4.	Quantity of rice actually milled (qtl)	3295.25	13276.25	34943.9
5.	Quantity of main product obtained (qtl)			
	Main product (Rice)	3295.25 (56.04)	13276.25 (56.97)	34942.75 (56.12)
6.	Quantity of by product obtained (qtl)			
	Broken rice	764.4 (13.00)	3054.61 (13.11)	8089.68 (13.00)
	Bran	795.03 (13.52)	3228.23 (13.85)	8367.4 (13.44)
	Husk	938.35 (15.96)	3415.28 (14.66)	9733.6 (15.63)
	Waste/ losses	86.98 (1.48)	328.95 (1.41)	1130.45 (1.82)
	Total	5880.01 (100)	23303.32 (100)	62263.88 (100)

Figures in parentheses are percentage to the total quantity processed.

From the table, it was revealed that the processing capacity of small, medium and large sized rice processing mills was 13.45, 61.75 and 151.93 quintal per day, respectively. Total ten rice mill was selected out of which individual processor owned by seven mill while in partnership owned by three mills. The total numbers of working days in the year respectively for small, medium and large sized rice mills were 245, 215 and 230 days, respectively. Thus, the number of working days of the small sized rice mills was higher than those of the medium and large sized rice mills.

In the small, medium and large size group of rice mills, the total estimated quantity of rice at full capacity utilization was 5880.01 quintals, 23303.32 quintals and 62263.88 quintals, respectively. The actual quantity of rice milled in small, medium and large size group was 56.04 per cent and 56.97 and 56.12 per cent respectively, of the installed capacity this indicates that the out-turn of whole rice received from paddy processing was higher in the case of medium sized rice mills as compared to small and large sized rice mills. The quantities of paddy processed were increasing over the size groups and were 3295.25, 13276.25 and 34942.75 quintal per mill in small, medium and large size groups respectively.

The quantities of broken rice over the size groups were 764.4 quintals, 3054.61 quintals and 8089.68 quintals respectively. The byproducts such as bran, husk obtained at small, medium and large sized groups were bran obtained 795.03 quintals, 3228.23 quintals and 8367.4 quintals respectively. In absolute terms, the quantities of husk were 938.35 quintals, 3415.28 quintals and 9733.6 quintals respectively in small, medium

and large size group of rice mills. And waste obtained 86.98 quintals 328.95 quintals and 1130.45 quintals respectively small, medium and large size group of rice mills. From the forgoing discussion, it is revealed that among the by product the quantity of husk was higher than the broken rice and bran. The quantities of rice obtained were found to be increasing over the size groups.

The quantity of broken rice obtained through rice processing was, however, relatively higher in respect of the medium sized rice mills, which accounted for 13.11 per cent of the total quantity of paddy processed. The quantity of broken rice was found to be 13.00 and 13.00 per cent in the small and large sized rice mills, respectively. From, the by-products, the recovery of bran and husk also showed the similar trend. The recovery of bran was 13.52 per cent, 13.85 per cent and 13.44 per cent in small, medium and large sized mills respectively. While the recovery of husk in small and medium sized mills was 15.96 and 14.66 per cent respectively while that in large sized mills was 15.63 per cent. From the results, it is evident that the recovery of whole rice increased with the increase in size of rice mills. While the recovery of broken rice and rice bran and rice husk decreased over the size groups showed inverse relationship between the installed capacity and recovery of broken rice and by products.

Capital investment in rice mills

Average capital investment was obtained by taking average of processing unit in each group considering major items like land, machinery and factory building.

Table 2: Capital investment in rice mill (Rs./unit.)

Sr. No.	Capital items	Size group		
		Small	Medium	Large
1.	Land	1300000 (38.46)	1650000 (36.67)	3387500 (45.90)
2.	Factory building	901250 (26.66)	1143987.5 (26.81)	1927750 (26.12)
3.	Machinery and other accessories	1080750 (31.97)	1253125 (29.37)	1689500 (22.89)
4.	Furniture and fixtures	9000 (0.27)	13062.5 (0.31)	13250 (0.18)
5.	Electrification	44250 (1.31)	173525 (4.07)	302500 (4.10)
6.	Vehicle	44750 (1.32)	46025 (1.08)	60375 (0.82)
	Total	3380000 (100.00)	4266662.5 (100.00)	7380875 (100.00)

*Figures in parentheses are percentages of total capital investments.

It is revealed from the table that the was 50 per cent of the capital investment was in land and factory buildings in each size group followed by machinery which constitute in small medium and large sized groups was observed in 31.97 per cent, 29.37 per cent and 22.89 per cent respectively. Furniture, electrification and vehicle investment formed a more or, less similar percent contribution in all size groups of processing units.

Annual cost structure of rice mills

The details of the average capital investment cost of the small, medium and large sized rice mills are presented in Table 3. Presents the item wise annual cost structure of the average rice mills belonging to different size groups. The per rice mill total cost of rice milling was Rs. 13.98 lakh, Rs. 18.87 lakh and Rs. 31.42 lakh per annum for small, medium and large size of rice mills, respectively. Out of which the total fixed cost was Rs. 7.87 lakh, Rs. 9.81 lakh and Rs. 16.90 lakh per annum.

Table 3: Annual operating cost of rice mill (Rs./unit.)

Sr. No.	Item of cost	Size groups		
		Small	Medium	Large
I.		Fixed cost		
1.	Opportunity cost of land	130000 (9.29)	165000 (8.74)	338750 (10.75)
2.	Depreciation on buildings@5%	45062.5 (3.22)	57199.38 (3.03)	96387.5 (3.06)
3.	Depreciation on machineries @10%	108075 (7.73)	125312.5 (6.64)	168950 (5.38)
4.	Depreciation on furniture @ 10 %	900 (0.06)	1306.25 (0.07)	1325 (0.04)
5.	Electrification	4425 (0.32)	17352.5 (0.92)	30250 (0.96)
6.	Vehicle	4475 (0.32)	4602.5 (0.24)	6037.5 (0.19)
7.	Interest on fixed capital@ 10 %	338000 (24.17)	426666.25 (22.60)	738087.5 (23.49)
8.	Expenditure on permanent labour	137500 (9.83)	159862.5 (8.47)	279625 (8.90)
9.	Taxes, Insurance and License fee	19250 (1.37)	23700 (1.25)	31225 (0.99)
	Total fixed cost	787687.5 (56.32)	981001.88 (51.97)	1690637.5 (53.80)
II.		Variable cost		
1.	Casual labour charges	318500 (22.77)	404200 (21.41)	669875 (21.32)
2.	Repair and maintenance	36750 (2.62)	61812.5 (3.27)	97750 (3.11)
3.	Telephone and telegraphs	3750 (0.27)	5000 (0.26)	8000 (0.25)
4.	Miscellaneous	61250 (4.38)	81162.5 (4.30)	129775 (4.13)
5.	Water charges	5512.5 (0.39)	7525 (0.40)	13544.13 (0.43)
6.	Electricity	116375 (8.32)	238332.9 (12.63)	360295 (11.47)
7.	Storage charges	872.81 (0.06)	5581.94 (0.29)	9085 (0.29)
8.	Office expenses	2350 (0.17)	5750 (0.31)	7960 (0.25)
9.	Interest on working capital @ 12 percent	65443.24 (4.68)	97123.78 (5.15)	155554.1 (4.95)
	Total variable cost	610803.5 (43.68)	906488.62 (48.02)	1451838 (46.20)
	Total operating cost	1398491 (100)	1887490.5 (100)	3142475.5 (100)

* Figures in parenthesis are work out percentages to total operating cost

While the total variable cost was Rs. 6.10 lakh, Rs. 9.06 lakh and Rs. 14.51 lakh per annum for small, medium and large size group of rice mill. It is, thus quite evident that the proportionate share of fixed cost in the total cost of rice milling showed the increasing trend over the size group. Interest on fixed capital formed major part i.e. 22.60 to 24.17 per cent total fixed cost followed by opportunity cost of land, expenditure on permanent labour. Depreciation on furniture, electrification and vehicle account less than one per cent in all size groups.

Average variable cost per unit per year for all size group revealed that casual labour charges formed major share in total variable cost. It showed that casual labour charges Rs. 318500, Rs. 404200, Rs. 669875 in small, medium and large size units respectively. It formed major per cent contribution

i.e. 21.32 to 22.77 per cent to total variable cost, followed by energy charges which include electricity, water, phone and miscellaneous etc formed second major per cent in total variable cost. Repair and maintenance charges were directly proportional to the all size of group and contributes least compared to other variable cost items. Interest on working capital taken @ 12 per cent to total variable cost was 4.68 to 5.15 per cent to total variable cost for rice mills.

This could be related with the pattern of capacity utilization of rice mills over the size group. It has been observed that the per cent utilization of installed capacity of rice mill increased over the size group of rice mills, showing thereby the capacity of rice mills was increasing in processing adequate quantity of their installed capacity. As a result, the per rice mill, variable cost did increase in proportion with the increase in installed

capacity. Average total cost per unit per year were Rs.1398491, Rs. 1887490.5 and Rs. 3142475.5 in small medium and large units respectively. Average total cost per unit per year for all size group revealed the share of total fixed cost was 51.97 to 56.32 per cent and 43.68 to 48.02 per cent share total variable cost of total incurred rice mill owners in processing of rice.

Financial viability of rice mills

An attempt was made to compute some of the financial test ratios *viz*; operating ratio, fixed ratio, gross ratio and capital turnover ratio, respectively for different sized rice mills and the result thereof are given in Table 4.

Table 4: Financial test ratio's in rice mills

Sr. No	Particulars	Size group		
		Small	Medium	Large
1.	Operating ratio	0.80	0.82	0.83
2.	Fixed ratio	0.087	0.030	0.021
3.	Gross ratio	0.96	0.95	0.96
4.	Capital turn over ratio	1.04	1.03	1.04

From the results, it was revealed that the operating ratio of rice milling was for the small, medium and large size group of rice mills, it was 0.80, 0.82 and 0.83 respectively. The fixed ratio in small, medium and large size group of rice mills was 0.087, 0.030 and 0.021, respectively. However, it was the least in large size group of rice mills. The gross ratio in small, medium and large size group was 0.96, 0.95 and 0.96, respectively in small, medium and large sized rice mills. From the gross ratio, it was revealed that the medium sized rice mills are financially more viable, followed by the small and large sized rice mills. All the three ratios, in all the size groups, were less than one indicated that rice milling was a

profitable activity to the processors. The capital turnover ratio was the least (1.03) in medium sized rice mills and was the highest (1.04) in the large and small sized rice mills, this confirmed the fact that the large and small sized rice mills are able to turn their investments into income to the greater extent.

Cost of rice processing

It includes total processing cost, marketing cost, cost of raw material and total cost incurred by rice mill owner per quintal. The economics of rice processing were worked out and presented in Table 5.

Table 5: Cost of rice processing (Rupees)

Sr. No.	Particulars	Small	Medium	Large
1.	Total fixed cost per unit	787687.5	981001.88	1690637.5
2.	Total variable cost per unit	610803.5	906488.62	1451838
3.	Total operating cost	1398491	1887490.5	3142475.5
4.	Quantity Processed/day in qtls	13.45	61.75	151.93
5.	No. of working days in a year	245	215.00	230.00
6.	Quantity rice processed per unit (qtls)	3295.25	13276.25	34943.9
7.	Fixed cost per quintal	239.03 (56.32)	73.89 (51.97)	48.38 (53.80)
8.	Variable cost per quintal	185.36 (43.68)	68.28 (48.02)	41.55 (46.20)
9.	Processing cost per quintal (7+8)	424.39	142.17	89.93
10.	Marketing cost per quintal	206.38	252.09	271.22
11.	Cost of raw material per quintal	2004.17	1940.64	1898.29
12.	Total cost incurred by rice mill owner (9+10+11)	2634.94	2334.9	2259.44

It is seen from the table that per unit total quantity processed was 3295.25, 13276.25 and 34943.9 quintals respectively in small, medium and large group. Processing cost varies according to the size group and total quantity processed. It revealed that marketing cost was Rs. 206.38, Rs. 252.09 and Rs. 271.22 per quintal in small, medium and large unit

respectively. Cost of raw material is taken at the market rates at the time to which data pertain. Total cost incurred by rice mill owner is calculated by adding processing cost, marketing cost and cost of raw material. It was Rs. 2634.94, Rs. 2334.9 and Rs. 2259.44 per quintal in small, medium and large unit respectively.

Table 6: Economics of rice processing

Sr. No	Main & by product	Small			Medium			Large			
		Qt. in kg	Rs./ kg	Total (Rs.)	Qt. in kg	Rs./ kg	Total (Rs.)	Qt. in kg	Rs./ kg	Total (Rs.)	
A)											
1.	Rice	56.04	42.00	2353.68	56.39	36.5	2058.23	56.11	35.00	1963.85	
2.	Broken rice	13.00	17.25	224.25	13.00	17.00	221	12.99	16.0	207.84	
3.	Bran	13.52	10.25	138.58	14.00	10.00	140	13.44	10.00	134.4	
4.	Husk	15.96	2.25	35.91	15.10	2.00	30.2	15.63	2.19	34.22	
5.	Waste	1.48	-	-	1.50	-	-	1.82	-	-	
B) Gross Returns				2752.42				2449.43			
C) Total cost				2634.94				2334.9			
D) Net Returns				117.48				114.53			
E) Benefit Cost Ratio				1.044				1.049			

Table 6, revealed that income per quintal is calculated by adding returns received from main and by-products after processing of raw material. In case of small size group amount of rice obtained was 56.04 kg and broken rice was 13.00 kg, bran was 13.52 kg, husk was 15.96 kg and waste material 1.48 kg. Prices of main and by-products were taken at the market rates at the time to which data pertain. In case of medium and large size groups amount of rice obtained was 56.39 and 56.11 kg respectively. Gross returns received were Rs. 2752.42, 2449.43, 2340.31 per quintal in small, medium and large units respectively. Net returns received were

calculated by subtracting total cost incurred by rice mill owner from gross returns. The benefit cost ratio was 1.044, 1.049, 1.035 in small, medium and large units respectively. The benefit cost ratio was the highest in medium size rice mills followed by small and large size rice mills.

Break even analysis of rice mill

The minimum quantity of finished product required for running the unit without loss was calculated using break even analysis.

Table 7: Break even analysis of rice (qtl./unit.)

Group	Total fixed cost (Afc)	Selling price (Ps)	Variable cost (Vc)	Actual quantity of processed	Break even quantity
Small	787687.5	2752.42	2395.91	3295.25	2209.44 (67.00)
Medium	981001.88	2449.43	2261.01	13276.25	5206.46 (39.21)
Large	1690637.5	2340.31	2211.06	34943.9	13080.36 (37.43)

Figures in parentheses are percentage to the actual quantity of processed.

The relative economic efficiency of the individual size group could be judged in terms of break even quantities. Therefore, an attempt was made to estimate break even point for small, medium and large sized rice mills. The break-even quantity of rice processing is the one at which total revenue equalizes total cost for average rice mills for individual size group of mill. The results on this behalf are presented in Table 7.

It is observed from the table that the per rice mill break-even quantity of rice was less than the actual quantity handled by all the size groups of rice mills. For small, medium and large

sized rice mills, the break-even quantity of paddy was 67.00, 39.21 and 37.43 per cent of the actual quantity milled by these mills, respectively. The estimated break-even quantity increased with the increase in the size of rice mills which was obviously related to their installed capacity.

Value addition in rice

It is obtained by subtracting cost of raw material and processing cost from returns obtained from main and by – products per quintal.

Table 8: Value addition in rice (Rs./quintal.)

Sr. No	Particulars	Small	Medium	Large
1.	Cost of raw material	2004.17	1940.64	1898.29
2.	Processing cost	424.39	142.17	89.93
3.	Gross returns	2752.42	2449.43	2340.31
4.	Value addition	323.86 (16.16)	366.62 (18.90)	352.09 (18.55)

Figures in parenthesis shows percent of value addition in cost of raw material

It is seen from the table that value addition in rice per quintal was Rs. 323.86, Rs. 366.62 and Rs. 352.09 in small medium and large units respectively. It revealed that per cent share of value addition in cost of raw material was 16.16, 18.90 and 18.55 per cent respectively in small, medium and large units respectively.

Conclusions

Per quintal total cost was decrease with increase in size of mills. The net return per quintal for paddy processing was found to be higher in case of small mills as compared to medium and large mills. Benefit cost ratio was also found to be higher in medium sized mills. To estimated break – even quantity was increase with the increase in the size of processing mills. Value addition in processing of paddy was higher in medium sized followed large and small rice mills.

Policy Implication

Government should provide subsidies to some extend for purchasing of processing machineries and equipment. The effort should be made to introduce improved management practices in the working of rice processing units for avoiding unproductive overhead costs of these units.

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