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Economic analysis and value addition in chilli powder processing in Nagpur district

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Abstract
The study assessed the cost, returns and value addition of Chilli powder processing in six selected processing units of Kalamna, Kamptee and Ramtek tahsils of Nagpur district during 2025-26. The average annual production was 2,30,667 kg, with a total processing cost of ₹232.27/kg and selling price of ₹247/kg. The units earned an average gross return of ₹571.78 lakh/year and net return of ₹36.19 lakh/year, with a B:C ratio of 1.07. The overall break-even point was 3,299.83 kg/year, with a 98.57 per cent margin of safety. Processing generated ₹35.23/kg gross value addition, ₹20.81/kg net value addition and 16.64 per cent value addition, indicating that Chilli powder processing is an economically viable activity with good potential for value addition and income generation.

Keywords: Chilli powder, dry chilli, processing, cost and returns, value addition, B:C ratio, break-even point, Nagpur district

1. Introduction
Agro-processing has become an important component of agricultural development as it converts raw agricultural commodities into products with greater convenience, improved marketability, and additional economic value. The spice sector is particularly important in India because of the wide domestic consumption and strong export demand for spices. Dry chilli (*Capsicum annuum* L.) is one of the major spice crops and is valued for its colour, pungency, flavour, and diverse applications in food preparation. Globally, chilli production covered about 18.03 lakh hectares and reached nearly 58.22 lakh tonnes in 2023, while India contributed approximately 27.82 lakh tonnes. Among the different products obtained through chilli processing, chilli powder is widely used in households, restaurants, food industries, and commercial food preparations. Converting dry chilli into powder involves activities such as cleaning, grading, destalking, grinding, sieving, and packaging, which transform the raw material into a convenient and commercially useful product.

Maharashtra is an important region for chilli production and trade, while Nagpur district provides favourable opportunities for chilli processing because of its market connectivity, transportation facilities, availability of raw material, and presence of processing enterprises. In the selected study area, chilli powder was produced by all six processing units, demonstrating its importance as a value-added chilli product. Processing can provide opportunities for income generation, employment creation, product diversification, and improved utilization of agricultural produce. Hence, evaluating the economics of chilli powder processing is important for understanding the expenditure incurred, returns generated, and value created through processing. The present study was conducted in selected chilli processing units of Nagpur district during 2025-26. The objectives of the study were to estimate the cost and returns of chilli powder processing and to work out the value addition resulting from the processing of dry chilli into chilli powder.

2. Methodology
The study was conducted during 2025-26 in selected Chilli powder processing units of Nagpur district using primary data collected through structured interviews. The analysis focused on estimating the cost and returns of Chilli powder processing and assessing the value addition achieved through the processing of dry Chilli into Chilli powder.

3.1 Selection of Area
This study was carried out in Nagpur district, as it was an important area for Chilli cultivation and processing. Many small and medium Chilli processing units were operated here, which made the district suitable for studying value-added Chilli powder. For the selection of processing units, three tahsils of Nagpur district, namely Kalamana, Kamptee, and Ramtek, were selected for the study.

3.2 Selection of Sample
In this study, randomly three tahsils were selected. From each tahsil two processing units were selected. Thus, a total of six units were selected for the study.

3.3 Data Collection
Primary data were collected from the selected processing units. Data were collected through personal interviews with the owners or managers of the units. A specially designed schedule was used to collect information related to cost, returns and processing of dry Chilli.

3.4 Period of Study
The data were collected for the period of year 2025-26.

3.5 Selection of Product
Chilli powder was selected as the value-added product of dry Chilli.

3.6 Analytical Tools
3.6.1 Fixed Cost
It includes data on the cost of machinery, building, furniture, wages of permanent employee, labour license, insurances and taxes. The data were collected from each processing unit on the above item etc.

3.6.2 Variable Cost
Variable cost consists of expenditure on purchase of raw material, wages of casual labour, oil and lubricants, energy charges, repair maintenance of machine, packing cost and interest on working capital.

3.6.3 Total Cost: Total cost of processing was composed of the total fixed cost and total variable cost and was calculated by adding these costs together.

Total Cost = Fixed Cost + Variable Cost

3.6.4 Gross Returns: The gross return was defined as the total rate of returns on an investment before the deduction of any expenses.

Gross Returns = Quantity of the product × Price per unit

3.6.5 Net Returns
Net returns referred to the return after deducting all expenses from the gross return generated by the investment.

Net Returns = Gross Returns − Total Cost

3.6.6 Benefit-Cost Ratio
The benefit-cost ratio compared the present value of all benefits with that of the cost and investment of the project.

B:C Ratio= $\frac{Gross\ return}{Total\ cost}$

3.6.7 Break-Even Point
Break-even point showed the minimum size of volume to recover total cost required for processing in a year.

BEP=$\frac{FC}{SP-VC}$

Where,
- FC = Fixed cost per unit
- SP = Selling price per unit
- VC = Variable cost per unit

3.6.8 Value Addition
Value addition due to processing of dry Chilli into Chilli powder was worked out by comparing the value of the processed product with the cost/value of the raw material and processing inputs involved in obtaining the finished product.

4. Result and Discussion
The results regarding the cost, returns, processing performance, break-even point and value addition of Chilli powder are presented and discussed in accordance with the objectives of the study.

4.1. Estimate the cost and returns of Chilli powder processing
To fulfill the first objective of the study regarding the estimation of cost and returns of chilli powder processing, the results obtained on the cost incurred and returns generated from chilli powder processing units are presented and discussed as follows.

4.1.1. Establishment Cost for Chilli Powder Processing

Table 1: Establishment Cost for Chilli Powder Processing (₹ lakh/year)

S. N.	Particulars	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Overall Average
1	Land	3.95	2.86	5.05	5.49	4.27	4.17	4.3
2	Building	11.86	8.16	13.83	15.5	12.18	11.81	12.22
3	Machinery & Equipment	4.26	3.02	5.32	5.49	4.27	4.03	4.4
4	Furniture & Fixtures	0.46	0.25	0.53	0.65	0.41	0.43	0.46
	Total Establishment Cost	20.52	14.29	24.74	27.13	21.12	20.44	21.37
	Annual Establishment Cost Recovery	2.05	1.3	2.06	2.09	1.51	1.36	1.73

The establishment cost of the selected Chilli powder processing units averaged ₹21.37 lakh, with the highest share accounted for by building (₹12.22 lakh), followed by machinery and equipment (₹4.40 lakh), land (₹4.30 lakh),

and furniture and fixtures (₹0.46 lakh). The total establishment cost ranged from ₹14.29 lakh in Unit 2 to ₹27.13 lakh in Unit 4, while the average annual establishment cost recovery was ₹1.73 lakh. Thus, building was the major component of establishment investment in the selected Chilli powder processing units.

4.1.2. Annual Production Quantity, Percentage Share and Annual Establishment Cost of Selected Dry Chilli Processing Unit: The average annual production of Chilli powder was 2,30,667 kg, with the highest production in Unit 4 (3,23,000 kg) and the lowest in Unit 2 (1,30,000 kg). Chilli powder accounted for an average 83 per cent of total production, ranging from 62.8 per cent in Unit 2 to 100 per cent in Units 1, 3 and 4. The average annual establishment cost was ₹2.00 lakh, varying from ₹1.30 lakh in Unit 2 to ₹2.09 lakh in Unit 4, indicating differences in the scale and product composition of the selected processing units.

Table 2: Annual Production Quantity, Percentage Share and Annual Establishment Cost of Selected Dry Chilli Processing Units

S. N.	Particulars	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Average
1	Chilli Powder (kg/year)	152000	130000	266000	323000	285000	228000	230667
	Percentage Share (%)	100	62.8	100	100	71.25	63.16	83
	Annual Establishment Cost (₹ lakh/year)	2.05	1.3	2.06	2.09	1.51	1.36	2

The average annual production of Chilli powder was 2,30,667 kg, with the highest production in Unit 4 (3,23,000 kg) and the lowest in Unit 2 (1,30,000 kg). Chilli powder accounted for an average 83 per cent of total production, ranging from 62.8 per cent in Unit 2 to 100 per cent in Units 1, 3 and 4. The average annual establishment cost was ₹2.00 lakh, varying from ₹1.30 lakh in Unit 2 to ₹2.09 lakh in Unit 4, indicating differences in the scale and product composition of the selected processing units.

4.1.3. Annual Fixed Cost of Chilli Powder Processing

Table 3: Annual Fixed Cost of Chilli Powder Processing

(₹ lakh/year)								
S. N.	Particulars	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Overall
1	Depreciation on Building @5%	0.59 (10.63)	0.41 (9.44)	0.69 (11.01)	0.78 (11.66)	0.61 (10.87)	0.59 (10.33)	0.61 (10.68)
2	Depreciation on Machinery @10%	0.43 (7.64)	0.30 (6.97)	0.53 (8.46)	0.55 (8.24)	0.43 (7.60)	0.40 (7.05)	0.44 (7.66)
3	Depreciation on Furniture @10%	0.05 (0.82)	0.03 (0.58)	0.05 (0.84)	0.07 (0.97)	0.04 (0.73)	0.04 (0.75)	0.05 (0.78)
4	Interest on Fixed Capital @12%	2.46 (44.14)	1.71 (39.33)	2.97 (47.18)	3.26 (48.52)	2.53 (45.13)	2.45 (42.98)	2.56 (44.88)
5	Annual Establishment Cost Recovery	2.05 (36.76)	1.30 (29.91)	2.06 (32.51)	2.09 (30.61)	1.51 (35.67)	1.36 (38.89)	1.73 (36.00)
6	Total Fixed Cost	5.58 (100.00)	4.35 (100.00)	6.30 (100.00)	6.72 (100.00)	5.61 (100.00)	5.70 (100.00)	5.71 (100.00)
7	Annual Quantity Processed (kg/year)	152000	130000	266000	323000	285000	228000	230667
8	Fixed Cost (₹/kg)	3.67	3.35	2.37	2.08	1.97	2.5	2.66

The average annual fixed cost of Chilli powder processing was ₹5.71 lakh, ranging from ₹4.35 lakh in Unit 2 to ₹6.72 lakh in Unit 4. Interest on fixed capital was the major component, accounting for 44.88 per cent, followed by annual establishment cost recovery (36.00%), depreciation on building (10.68%), machinery (7.66%), and furniture (0.78%). The average quantity processed was 2,30,667 kg/year, resulting in an average fixed cost of ₹2.66/kg, which ranged from ₹1.97/kg in Unit 5 to ₹3.67/kg in Unit 1.

4.1.4. Annual Variable Cost of Chilli Powder Processing

Table 4: Annual Variable Cost of Chilli Powder Processing (₹lakh/year)

S. N.	Particulars	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Overall Average
1	Raw Material	311.12 (89.67)	264.51 (87.23)	559.49 (92.64)	689.27 (93.37)	617.85 (93.01)	475.07 (90.90)	486.22 (91.76)
2	Labour	3.36 (0.97)	3.12 (1.03)	5.03 (0.83)	5.23 (0.71)	4.16 (0.63)	5.11 (0.98)	4.34 (0.82)
3	Electricity	1.79 (0.52)	1.95 (0.64)	2.50 (0.41)	3.00 (0.41)	2.76 (0.42)	3.83 (0.73)	2.64 (0.50)
4	Fuel	0.90 (0.26)	1.04 (0.34)	1.30 (0.22)	1.49 (0.20)	1.31 (0.20)	1.73 (0.33)	1.30 (0.24)
5	Packaging	4.20 (1.21)	7.02 (2.31)	6.70 (1.11)	8.49 (1.15)	7.67 (1.15)	8.32 (1.59)	7.07 (1.33)
6	Transportation	3.47 (1.00)	3.03 (1.00)	6.04 (1.00)	7.38 (1.00)	6.64 (1.00)	5.23 (1.00)	5.30 (1.00)
7	Repair and Maintenance	0.59 (0.17)	0.78 (0.26)	0.90 (0.15)	1.10 (0.15)	1.00 (0.15)	1.37 (0.26)	0.96 (0.18)
8	Interest on Working Capital @10%	21.52 (6.20)	21.80 (7.19)	21.95 (3.63)	22.26 (3.02)	22.90 (3.45)	21.99 (4.21)	22.07 (4.17)
9	Total Variable Cost	346.95 (100.00)	303.25 (100.00)	603.91 (100.00)	738.22 (100.00)	664.29 (100.00)	522.65 (100.00)	529.88 (100.00)
10	Annual Quantity Processed (kg/year)	152000	130000	266000	323000	285000	228000	230667
11	Variable Cost (₹/kg)	228.26	233.27	227.03	228.55	233.08	229.23	229.69

The average annual variable cost of Chilli powder processing was ₹529.88 lakh, ranging from ₹303.25 lakh in Unit 2 to ₹738.22 lakh in Unit 4. Raw material was the major component, accounting for 91.76 per cent (₹486.22 lakh) of total variable cost, followed by interest on working capital (4.17%) and packaging (1.33%). The average quantity processed was 2,30,667 kg/year, with an average variable cost of ₹229.69/kg, ranging from ₹227.03/kg in Unit 3 to ₹233.27/kg in Unit 2.

4.1.5. Total Cost of Chilli Powder Processing: The average total cost of Chilli powder processing was ₹535.59

lakh/year, comprising ₹529.88 lakh variable cost and ₹5.71 lakh fixed cost. The highest total cost was recorded in Unit 4 (₹744.94 lakh), while the lowest was in Unit 2 (₹307.60 lakh). At an average processing quantity of 2,30,667 kg/year, the total cost was ₹232.27/kg, ranging from ₹229.40/kg in Unit 3 to ₹236.62/kg in Unit 2.

Table 5: Total Cost of Chilli Powder Processing (₹ lakh/year)

S. N.	Particulars	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Overall
1	Annual Variable Cost	346.95	303.25	603.91	738.22	664.29	522.65	529.88
2	Annual Fixed Cost	5.58	4.35	6.3	6.72	5.61	5.7	5.71
3	Total Cost	352.53	307.6	610.21	744.94	669.9	528.35	535.59
4	Annual Quantity Processed (kg/year)	152000	130000	266000	323000	285000	228000	230667
5	Total Cost per kg (₹/kg)	231.93	236.62	229.4	230.63	235.05	231.73	232.27

Table 6: Gross Return from Chilli Powder Processing (₹ lakh/year)

Sr. No.	Particulars	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Overall
1	Quantity of Chilli Powder Produced (kg/year)	152000	130000	266000	323000	285000	228000	230667
2	Selling Price (₹/kg)	240	245	245	250	252	250	247
3	Gross Return (₹ lakh/year)	364.8	318.5	651.7	807.5	718.2	570	571.78

4.1.6. Gross Return from Chilli Powder Processing

The average gross return from Chilli powder processing was ₹571.78 lakh/year, based on an average production of 2,30,667 kg/year and a selling price of ₹247/kg. The highest gross return was obtained in Unit 4 (₹807.50 lakh), while the lowest was recorded in Unit 2 (₹318.50 lakh). The variation in gross returns was mainly due to differences in production quantity and selling price among the selected processing units.

4.1.7. Net Return from Chilli Powder Processing

Table 7: Net Return from Chilli Powder Processing (₹ lakh/year)

S. N.	Particulars	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Overall
1	Gross Return	364.8	318.5	651.7	807.5	718.2	570	571.78
2	Variable Cost	346.95	303.25	603.91	738.22	664.29	522.65	529.88
3	Fixed Cost	5.58	4.35	6.3	6.72	5.61	5.7	5.71
4	Total Cost	352.53	307.6	610.21	744.94	669.9	528.35	535.59
5	Net Return	12.27	10.9	41.49	62.56	48.3	41.65	36.19
6	B:C Ratio	1.03	1.04	1.07	1.08	1.07	1.08	1.07

The selected Chilli powder processing units earned an average net return of ₹36.19 lakh/year, with returns ranging from ₹10.90 lakh in Unit 2 to ₹62.56 lakh in Unit 4. The overall B:C ratio was 1.07, indicating that every ₹1.00 invested generated ₹1.07 in return. All units recorded positive net returns and B ratios above unity, indicating the economic viability of Chilli powder processing.

4.1.8. Break-Even Point and Margin of Safety of Chilli Powder Processing: The overall break-even point was 3,299.83 kg/year, equivalent to ₹8.15 lakh, while the average margin of safety was 2,27,367.17 kg, valued at ₹563.63 lakh. The overall percentage margin of safety was 98.57 per cent, ranging from 96.86 per cent in Unit 1 to 98.96 per cent in Unit 5. The high margin of safety indicates that the selected processing units operated substantially above their break-even levels, reflecting a favourable operational position.

Table 8: Break-Even Point and Margin of Safety of Chilli Powder Processing

S. N.	Particulars	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Overall
1	Actual Quantity Processed per Year (kg)	152000	130000	266000	323000	285000	228000	230667
2	Annual Fixed Cost (₹ lakh/year)	5.58	4.35	6.3	6.72	5.61	5.7	5.71
3	Selling Price per kg (₹)	240	245	245	250	252	250	247
4	Variable Cost per kg (₹)	228.26	233.27	227.03	228.55	233.08	229.23	229.69
5	Break-Even Point - Physical Quantity (kg)	4770.46	3558.64	3838.83	4454.23	2964.44	2749.28	3299.83
6	Break-Even Point - Monetary Value (₹ lakh)	11.45	8.72	9.4	11.14	7.47	6.87	8.15
7	Margin of Safety - Physical Quantity (kg)	147229.54	126441.36	262161.17	318545.77	282035.56	225250.72	227367.17
8	Margin of Safety - Monetary Value (₹ lakh)	353.35	309.78	642.3	796.36	710.73	563.13	563.63
9	Percentage of Margin of Safety - Physical Quantity (%)	96.86	97.26	98.56	98.62	98.96	98.79	98.57
10	Percentage of Margin of Safety - Monetary Value (%)	96.86	97.26	98.56	98.62	98.96	98.79	98.57

4.2. Work out the value addition due to processing of dry Chilli into Chilli powder

To fulfill the second objective of the study regarding the estimation of value addition due to processing of dry chilli into chilli powder, the results obtained on the cost of processing, gross value addition and net value addition are presented and discussed as follows.

4.2.1 Value Addition Due to Processing of Dry Chilli into Chilli Powder

Table 9: Value Addition Due to Processing of Dry Chilli into Chilli Powder (₹/kg)

S. N.	Particulars	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Overall
1	Cost of raw dry chilli	206.97	205.8	212.38	215.68	219.12	210.66	211.77
2	Cleaning, grading and handling cost	1.18	1.5	0.94	0.93	0.97	1.68	1.2
3	Labour charges	4.42	8.73	3.78	3.24	3.35	4.69	4.7
4	Fuel and electricity	1.77	2.3	1.43	1.39	1.43	2.44	1.79
5	Repair and maintenance	0.39	0.6	0.34	0.34	0.35	0.6	0.44
6	Water, telephone and communication	0.42	0.5	0.34	0.34	0.35	0.6	0.43
7	Packaging, labelling and miscellaneous	2.76	5.4	2.52	2.63	2.69	3.65	3.28
8	Interest on working capital	0.66	1	0.56	0.56	0.57	0.75	0.68
9	Total Variable Cost	215.18	223.67	219.46	222.56	228.97	219.94	221.63
10	Total Fixed Cost	4.92	6.33	3.82	3.18	4.03	5.06	4.56
11	Total Cost of Processing	220.1	230	223.28	225.74	233	225	226.19
12	Selling price of chilli powder	240	245	245	250	252	250	247
13	Gross Value Addition	33.03	39.2	32.62	34.32	32.88	39.34	35.23
14	Net Value Addition (Net Return)	19.9	15	21.72	24.26	19	25	20.81
15	Value Addition (%)	15.96	19.05	15.36	15.91	15.01	18.68	16.64

The processing of dry Chilli into Chilli powder resulted in an average gross value addition of ₹35.23/kg and net value addition of ₹20.81/kg, with an overall value addition of 16.64 per cent. The average raw dry Chilli cost was ₹211.77/kg, while the total processing cost was ₹226.19/kg against an average selling price of ₹247/kg. The percentage value addition ranged from 15.01 per cent in Unit 5 to 19.05 per cent in Unit 2, indicating that processing substantially increased the economic value of dry Chilli.

5. Conclusion: Chilli powder processing was found to be an economically viable value-added activity, generating a positive average net return of ₹36.19 lakh per year with a B:C ratio of 1.07. The processing of dry Chilli resulted in an average net value addition of ₹20.81/kg, with an overall value addition of 16.64 per cent. The high margin of safety of 98.57 per cent further indicated a favourable operational position of the selected processing units. Overall, Chilli powder processing provides considerable potential for increasing the economic value of dry Chilli.

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