Economic viability and financial feasibility of secondary processing unit of turmericin Chamarajanagar district of Karnataka, India

Abstract

Turmeric is an important commercial crop with both domestic and international demand facing challenges due to the absence of organized processing units at production centres. Addressing this gap requires a thorough analysis of the economic viability and financial feasibility of establishing turmeric processing units to empower stakeholders and foster agricultural advancement in the study area. The study was conducted in Chamarajanagar district of Karnataka, by collecting primary data on establishment and annual processing costs and secondary data on market prices of turmeric rhizome and powder. Financial feasibility analysis revealed positive Net Present Value (NPV)of ₹ 1,714.36 lakh and ₹ 623.56 lakh, Benefit Cost Ratio (BCR) of 2.37 and 1.76, Internal Rate of Returns (IRR) of 76 and 57 per cent at current and constant market prices, respectively. The findings showed that the establishment of turmeric processing units are both economically viable and financially feasible. Emphasizing this potential through extension systems can empower farmers to maximize benefits through mechanized value addition. These insights provide valuable guidance for entrepreneurs, Farmers Producers Organizations, Self Help Groupsand cooperatives facilitating informed decisions on establishing small-scale turmeric processing units.

Key words: Financial feasibility, NPV, BCR, IRR, Sensitivity analysis

INTRODUCTION

Turmericis extracted from the rhizomes of *Curcuma longa*, known as "the golden spice of India," holds significant importance as a primary spice and cash crop (Ghosh, *et al.,* 2015).It is utilized across various sectors including condiments, dye, and medicinal applications (Patil, *et al.,* 2009; Choudhary & Rahi, 2018). With a global production nearing 1.5 million tonnes annually, India's domestic market consumes the majority, accounting for approximately 80 per cent of world turmeric production and 60 per cent of world exports (Jaiswal, *et al.*, 2021). Indian turmeric is highly esteemed worldwide, exported to over 132 countries, with exports of 1.37 lakh tonnes valued at USD 119.25 million in 2021-22 (Anonymous, 2021). Processing turmeric into value-added products, such as turmeric powder, not only enhances nutritional and food security but also boosts profitability and offers opportunities for

entrepreneurship development at various scales. Despite the high cost of production, turmeric remains a favoured cash crop among farmers, often cultivated on even the smallest patches of land, driven by its anticipated profits and perceived as a symbol of good fortune (Kaja andGellaboina., 2017).Primary processing at the farmers' level is becoming more burdensome, contributing significantly to high production costs, about 15% of the total. Additionally, there's a notable lack of machinery for essential operations like sowing, weeding, and harvesting. Interventions are needed to support primary processing, particularly in improving technology for boiling and drying fresh turmeric and facilitating its adoption by farmers.

The economic and social benefits of turmeric cultivation are significant in Karnataka, impacting both the state economy and the well-being of farmers. A decline in turmeric production could harm the state's economy, while an expanding turmeric production system has the potential to boost farmers' incomes, create employment opportunities, alleviate poverty, enhance food security and contribute to overall social development (Abeynayaka, *et al.,* 2020). Recognizing the potential for establishing a self-sufficient commercial venture in turmeric cultivation, there is a timely and statewide need for information on the economics of turmeric production. However, the lack of sufficient secondary processing units in the state often leads to further processing occurring in neighbouring states. Therefore, assessing the economic viability, financial feasibility and price variability associated with turmeric cultivation in Karnataka is crucial. This assessment aims to recommend measures for improvement and provide valuable insights for investors, entrepreneursand policymakers, ultimately enhancing the livelihoods of farmers.

METHODOLOGY

Sampling procedure

Chamarajanagar district held a leading position in turmeric cultivation in Karnataka, hence, the study area was purposively selected. Primary data was obtained from the farmers, processors and consumers using pre-tested schedules through personal interview method to evaluate. The information pertaining to secondary processing units including establishment costs, investments in fixed and working capital and annual returns were collected directly from processors. Additionally, the retail price of turmeric powder was obtained from the Retail Price Index of Turmeric in India, published by Statista Research Development in 2022.

Analytical tools and techniques employed

Discounted capital budgeting technique

The cost of turmeric rhizome and powder has risen by 7 and 10 per cent respectively, calculated on both current and constant market prices over the years. After computing the growth rates for turmeric rhizome and powder prices, were determined to be 7 and 10 per cent respectively. Using this cash outflow and inflow for a 15-year period were calculated.

i) **Cash inflow:** It is the annual value generated by the production of turmeric powder. The processing unit operates at a capacity of one tonne per day, operating for 200 days each year.

ii) **Cash outflow:** Cash out flow is the total expenses incurred, including costs for rhizome, labour charges, electricity, packing material, salaries to permanent staff, maintenance of processing unit and building and interest on working capital.

iii) **Net cash flow:** It is the difference between the cash inflow and cash outflow.

iv) **Life period:** The life period of the project aligns with the lifespan of the machinery, *i.e.,* 15 years

v) **Discount rate:** For calculation of net present value and benefit cost ratio 12 per cent discount rate was used which was the normal lending rate for long term projects.

vi) **Discounted cash flow measures:** The financial feasibility of turmeric processing unit was evaluated using discounted measures such as NPV, BCR and IRR.

vii) **Net present value (NPV):** It is the difference between the sum of present value of benefits and sum of present value of costs at the given discount rate.

$$NPV = \Sigma_{t=1}^{n} \frac{B_t - C_t}{(1+r)^t}$$

Where, B_t = Benefits in t^{th} year

C_t = Costs in t^{th} year

n = Number of years

r = Discount rate

b) Benefit-Cost Ratio (BCR): The BCR is the ratio of sum present value of benefit to sum of present value of cost for a given discount rate. It shows how much benefits can be generated per rupee of investment.

$$\text{Benefit - Cost ratio} = \Sigma_{t=1}^{n} \frac{B_t/(1+r)^t}{C_t/(1+r)^t}$$

c) Internal Rate of Return (IRR): IRR is the discount rate which makes the net present value of cash flow equal to zero. A calculated IRR greater than the bank interest rate, which represents the opportunity cost of capital, indicates the investment's viability(opportunity cost of capital).

$$IRR = \Sigma_{t=1}^{n} \frac{B_t - C_t}{(1+r)^t} = 0$$

These discounted measures are carried out under two conditions:

i. **Constant market price:** In this case the price of turmeric rhizome and powder remains the constant at the existing market price for 15 years.

ii. **Current market price:** In this case the price of turmeric rhizome and powder is annually increasing by 7 and 10 per cent respectively.

Sensitivity analysis: Sensitivity analysis was carried out to assess the consistency of the project appraisal estimates among fluctuations in costs, prices, and yields.

For sensitivity analysis two assumptions were made:

I. The price of turmeric rhizome and powder was increased by 7 and 10 per cent from the existing price levels.

II. The price of turmeric rhizome and powder was decreased by 7 and 10 per cent from the existing price levels.

RESULTS AND DISCUSSION

Economic viability of turmeric processing unit

The expenditure and returns of the turmeric processing unit were calculatedand the results are given in Table 1. Total establishment expenditure amounted to ₹ 147.53 lakhs. The cost of processing machines and accessories shared a relatively higher proportion (65.30 %) followed by land and civil construction value (28.88 %). Annual share of establishment cost was ₹ 9.84 lakhs. Variable costs comprised 92.91 per cent of the total annual processing cost, with rhizome costs alone representing the highest proportion at 77.54 per cent.

Table 1: Economic viability of turmeric processing unit

Sl. No.	Particulars	Amount (₹ in lakh)	Percent to total cost
I.	Establishment of processing unit		
1.	Land and civil construction	42.60	28.88
2.	Cost of processing machines and accessories	96.33	65.30
3.	Office furniture and fixtures	0.60	0.41
4.	Miscellaneous expenses	1.50	1.02
5.	Pre-operative expenses	6.50	4.41
	Total establishment expenses	**147.53**	**100.00**
	Annual share of establishment cost	**9.84**	**6.67**
	Annual processing expenditure		

II.	Total annual variable cost		
1.	Cost of rhizome	140.00	77.54
2.	Labour charges	1.41	0.78
3.	Cost of electricity	2.50	1.38
4.	Packaging materials	4.50	2.49
5.	Transportation cost	1.53	0.85
6.	Interest on working capital @12 per cent	17.81	9.86
	Total annual variable cost	**167.75**	**92.91**
III.	Total annual fixed cost		
1.	Salary to permanent staff	0.75	0.42
2.	Maintenance cost of processing unit and building	0.45	0.25
3.	Rental value of building	3.56	1.97
4.	Depreciation of machineries	5.65	3.13
5.	Depreciation of building	1.01	0.56
6.	Interest on fixed investment @12 per cent	1.37	0.76
	Total annual fixed cost	**12.79**	**7.09**
	Total annual processing cost	**180.54**	**100.00**
III.	Cost of processing per tonne	0.90	
IV.	Gross income per year	360.00	
V.	Net returns	179.46	
VI.	Benefit-Cost ratio	1.99	

The total annual fixed cost for the turmeric processing industry amounted to ₹ 12.79 lakhs, representing 7.09 per cent of the total annual processing cost. This fixed cost covered salaries for permanent staff, maintenance expenses for the processing unit and building, building rental value, machinery and building depreciation and interest on fixed investments. The total annual processing cost was ₹ 180.54 lakhs, with an estimated gross income of ₹ 360.00 lakhs and the net returns of ₹ 179.46 lakhs. Thus, the BC ratio obtained was 1.99 indicating economic viability of establishing a turmeric processing unit in the study area. Similar findings are in line with the study conducted by Ashwini, *et al.* (2022). To strengthen direct linkages through suitable contract farming models, liberal credit policy to modernize processing units and encouraging the formation of small industries consortia or associations for collective marketing and sales promotion was suggested by Sharma, *et al.* (2010).

Financial feasibility of establishing a secondary processing unit of turmeric

The financial feasibility analysis for establishing a turmeric processing unit for producing turmeric powder per annum with a capacity of one tonne per day was presented in Tables 2 and 3 with current and constant market prices. The results of financial feasibility analysis were represented in the Table 4.

To assess the financial feasibility of investment in turmeric processing unit, discounted cash flow including of Net Present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR) were calculated at 12 per cent discount rate. The NPVof turmeric powder processing unit was ₹ 1714 lakhs with current marketprices and ₹ 624 lakhs at constant prices,affirming the viability of investing in the secondary processing unit for turmeric (Table 2&3). The benefit- cost ratio for turmeric processing unit was 2.37 with current market prices and 1.76 at constant prices. Since BCR is greater than one, the investment on turmeric powder processing plant is financially feasible.Internal rate of return was found to be 76 and 57 per cent in current and constant prices respectively, which is greater than the interest rate on loan lent by the commercial banks, indicating the financial feasibility of investment in turmeric processing unit (Table 4). It could be concluded that NPV of investment on secondary processing unit for 15 years will be greater than zero, BCR will be more than one for investment on a secondary processing unit over its lifespan and IRR of establishing a secondary processing unit is more than the interest rate on long-term loans provided in the commercial bank. The similar findings were reported by Karthik and Amarnath (2014) confirming that the feasibility of establishing rural turmeric processing industry on a cooperative basis with a positive value of NPV, BCR of greater than oneand IRR of more than the current bank rate and further recommended that the State Government should provide support to the industry and financial institutions should extend sufficient credit for such ventures.

Table 2: Financial feasibility analysis of turmeric processing unit with current market price **(₹ in lakhs)**

Year	Initial investment	Cash outflow	Cash inflow	Net cash flow	NPV at 12%	PV (Outflows)	PV (Inflows)
0	147.53	147.53	0.00	-147.53	-147.53	147.53	0.00
1		35.90	79.20	43.30	38.66	32.05	70.71
2		76.82	174.24	97.42	77.66	61.24	138.90

3		123.30	287.50	164.20	116.87	87.76	204.63
4		153.92	368.95	215.03	136.66	97.82	234.48
5		164.69	405.85	241.15	136.84	93.45	230.29
6		176.22	446.43	270.21	136.90	89.28	226.18
7		188.56	491.08	302.52	136.84	85.29	222.14
8		201.76	540.18	338.43	136.69	81.49	218.17
9		215.88	594.20	378.32	136.43	77.85	214.28
10		230.99	653.62	422.63	136.08	74.37	210.45
11		247.16	718.99	471.82	135.64	71.05	206.69
12		264.46	790.88	526.42	135.12	67.88	203.00
13		282.97	869.97	587.00	134.52	64.85	199.38
14		302.78	956.97	654.19	133.86	61.96	195.81
15		323.98	1,052.67	728.69	133.13	59.19	192.32
					1,714.36	1,253.07	2,967.43

Table 3: Financial feasibility analysis of turmeric processing unit with constant market price (₹ in lakhs)

Year	Initial investment	Cash outflow	Cash inflow	Net cash flow	NPV at 12%	PV (Outflows)	PV (Inflows)
0	147.53	147.53	0.00	-147.53	-147.53	147.53	0.00
1		33.55	72.00	38.45	34.33	29.96	64.29
2		67.10	144.00	76.90	61.30	53.49	114.80
3		100.65	216.00	115.35	82.10	71.64	153.74
4		117.42	252.00	134.58	85.53	74.63	160.15
5		117.42	252.00	134.58	76.36	66.63	142.99
6		117.42	252.00	134.58	68.18	59.49	127.67
7		117.42	252.00	134.58	60.88	53.12	113.99
8		117.42	252.00	134.58	54.35	47.43	101.78
9		117.42	252.00	134.58	48.53	42.34	90.87
10		117.42	252.00	134.58	43.33	37.81	81.14
11		117.42	252.00	134.58	38.69	33.76	72.44
12		117.42	252.00	134.58	34.54	30.14	64.68
13		117.42	252.00	134.58	30.84	26.91	57.75
14		117.42	252.00	134.58	27.54	24.03	51.56
15		117.42	252.00	134.58	24.59	21.45	46.04
					623.56	820.35	1,443.90

Table 4: Financial feasibility analysis at current and constant market prices

Particulars	NPV (₹ lakh)	BCR	IRR (%)
Current market price	₹ 1,714.36	2.37	76
Constant market price	₹ 623.56	1.76	57

Sensitivity analysis

NPV for the turmeric processing unit was ₹ 1934 lakhs with current prices and ₹ 721 lakhs with constant prices as the price of turmeric rhizome and powder increased by seven and ten per cent from the existing price level, respectively. The NPV was decreased to ₹ 1495 lakhs with current prices and 526 lakhs with constant prices as the price of turmeric rhizome and powder decreased by seven and ten per cent from the existing price level, respectively

(Table 5). Similar findings are in line with the study conducted by Varalakshmi (2016) on chicken nuggets processing unit, showed that variable costs and selling price had more impact on profitability and viability of processing plants.

Table 5: Sensitivity analysis of turmeric processing unit

Particulars	NPV (₹)			BCR			IRR (%)		
	X	Y	Z	X	Y	Z	X	Y	Z
Current market price	1714.36	1933.71	1495.00	2.37	2.45	2.27	76	82	70
Constant market price	623.56	720.85	526.26	1.76	1.83	1.68	57	62	51

Note:X- Existing price level, Y- Increase in turmeric rhizome and turmeric powder price at seven and ten per cent, respectively, Z- Decrease in turmeric rhizome and turmeric powder price at seven and ten per cent,respectively

The BCR for the turmeric processing unit increased to 2.45 and 1.83 with currentand constant prices as the price of turmeric rhizome and powder increased by seven and ten per cent from the existing price level, respectively. Similarly, the BCR was decreased to 2.27 and 1.68 with current and constant prices as the price of turmeric rhizome and powder decreased by seven and ten per cent from the existing price level, respectively. Internal rate of returns from turmeric processing unit increased to 82 per cent and 62 per cent with current and constant prices as the price of turmeric rhizome and powder increased by seven and ten per cent from the existing price level, respectively. The IRR was decreased to 70 and 51 per cent with current and constant prices as the price of turmeric rhizome and powder decreased by seven and ten per cent from the existing price level, respectively.

CONCLUSION

Financial feasibility analysis of setting up a turmeric processing unit showed positive NPV, BCR greater than one and IRR higher than the bank's commercial lending rate. The study concluded that establishing such a unit is not only economically viable but also financially feasible as an entrepreneurial endeavour. Sensitivity analysis further supported these findings, showing that even with fluctuations in turmeric prices, the project remained profitable, with NPV, BCR, and IRR surpassing the interest rate on long-term loans. Therefore, investing in a secondary processing unit in the study area is considered economically viable and financially feasible suggesting opportunities for entrepreneurs and organizations with potential support from financial institutions. It is essential to emphasize the role of the extension system in capacity building for farmers enabling them to maximize the benefits of modern technologies such as mechanized value addition. This emphasizes the

importance of continued support and education within the agricultural sector to ensure sustainable growth and development. Moreover, this study provides valuable insights for entrepreneurs, Farmers Producers Organizations, Self Help Groups, and cooperatives, enabling them to gauge the economic viability and financial feasibility of establishing small-scale turmeric processing plants. Such initiatives align with the government's "One District One Product" scheme, aimed at enhancing the turmeric value chain in the study area.

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