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Economic Analysis and Feasibility of Turmeric Processing Units in Guntur District of Andhra Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study aims to analyze the economics of turmeric processing units in Guntur district of Andhra Pradesh. The study focused on cost and returns associated with turmeric processing units and constraints faced by the turmeric processors in Guntur district of Andhra Pradesh. The data

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was collected from 10 processing units using purposive random sampling from three mandals in Guntur district viz., Duggirala, Kollipara and Mangalagiri. The processing units were divided into organized and unorganized units based on their processing capacity. The economic viability of both sectors is confirmed through positive Net Present Value (NPV) and favorable Benefit-Cost (BCR) ratios at varying discount rates. There is high Internal Rate of Return (IRR) of 58.24% in unorganized units and 49.52% in organized units indicating the profitability in the turmeric processing units. Break-even analysis further underscores the efficiency of both sectors, with actual production significantly exceeding the break-even output, confirming the economic sustainability of turmeric processing in the region. The findings demonstrate that despite the higher costs associated with organized units, both organized and unorganized turmeric processing units are profitable and viable enterprises in Guntur district. The turmeric processing industry in Guntur district, Andhra Pradesh, faces significant challenges that impact its efficiency and profitability. Key processing constraints include price fluctuations, procurement instability, and labor shortages. The turmeric processing industry in Guntur district, Andhra Pradesh, faces significant challenges that impact its efficiency and profitability. Key processing constraints include price fluctuations, procurement instability, and labor shortages.

Keywords: Turmeric; NPV; BCR; IRR; Break even output.

1. INTRODUCTION

India is often referred to as the "Spice Bowl of the World" due to its extensive variety of spices cultivated since ancient times. One of the most revered spices in India is turmeric (*Curcuma longa* L.), belonging to the family Zingiberaceae and often called Indian Saffron, and is native to South East Asia, especially India. India's turmeric production in 2022-23 is estimated as 11.7 lakh metric tonnes, while the same according to first advance estimates of 2023-24 is at 10.75 lakh metric tonnes (Turmeric Outlook, January 2024). The major trading hubs of turmeric in India are mainly Nizamabad (Telangana), Duggirala (Andhra Pradesh), Sangli (Maharashtra) and Salem, Erode, Dharmapuri and Coimbatore (Tamil Nadu). Andhra Pradesh is one of the major states cultivating and producing turmeric in India. In this state there are five agro-climatic zones Duggirala zone, Y.S.R Kadapa zone, Nizamabad zone, Godavari zone and Agency. During the year 2021-22 the area under turmeric cultivation in Andhra Pradesh was 25,500 acres. Y.S.R Kadapa stands at first position followed by Krishna and Guntur districts respectively. Turmeric is grown on 4,348 acres in the erstwhile Guntur district, with 1,881 acres in Guntur, 1,645 acres in Bapatla, and 820 acres in Palnadu.Total production is 17996 metric tonnes. Guntur hosts the largest turmeric market in Duggirala, and the crop is primarily cultivated in Tadepalli, Mangalagiri, Kollipara, Duggirala, Tenali, Medikonduru, Vemuru, Kolluru, Bhattiprolu, Amruthaluru, Chunduru, Repallemandals and island villages in Bapatla.

Turmeric is a key spice crop in India, particularly in Andhra Pradesh's Guntur region, which has a large area under cultivation. The scope of the study is comprehensive, covering all aspects of turmeric processing, from raw material production to marketing the finished product. It aims to identify key factors for the success and sustainability of processing units, such as cultivation methods, processing techniques, marketing strategies, and industry-related policies. The study examines challenges faced by turmeric processing units, including outdated methods, lack of modern technology, high production costs, poor market infrastructure, and regulatory issues. Additionally, it explores opportunities for growth and innovation that can enhance competitiveness and ensure long-term sustainability. Growth in the turmeric processing sector could boost export revenues, support rural development, and significantly contribute to the agricultural Gross Domestic Product.

2. LITERATURE REVIEW

BM et al., (2024) studied the economic dynamics of turmeric production and primary processing in Chamarajanagar district, Karnataka. The analysis employed different cost concepts and the Garrett Ranking Technique. Turmeric cultivation alone yields a net return of ₹18,134 per acre, while incorporating primary processing increases this figure to ₹24,775 per acre. The cost-benefit analysis underscores the profitability of turmeric production, with ratios of 1.21 and 1.25 with and without primary processing, respectively.

Kumar et al., (2023) studied on the cost and returns analysis of turmeric production in Kodumudi block of Erode district. It was calculated that growing turmeric would cost ₹1,46,151 per acre. The gross profit per acre realized was ₹2,60,347 and the net profit was ₹1,14,196.

Borbaruah & Barman, (2023) conducted a study to identify the production and marketing constraints faced by ginger and turmeric growers in the KarbiAnglong and Jorhat districts of Assam during September 2021. The study revealed that in the hill district, the major production and marketing constraints were the low adoption of improved production practices and the influence of middlemen/local traders. In the plains, unfavorable weather conditions and poor market infrastructure were significant issues.

Devi & Bhoi, (2022) conducted a study to compare the economic aspects of processed and non-processed turmeric farmers in middle Gujarat. The results indicated that the total cost per hectare was higher for processed (₹2,10,887 per ha) than non-processed turmeric farmers (₹1,70,922 per ha). However, a significant difference was observed in price per unit, gross return, the net return and benefit-cost ratio realized by the farmers who were selling the produce in powder form as compared to fresh.

Govindasamy et al., (2021) studied the cost and profitability of turmeric cultivation in the Coimbatore district. The study found that both total variable cost and total fixed cost were higher for large farmers, accounting for 40.17 per cent and 13.44 per cent, respectively. Despite these costs, turmeric cultivation proved to be profitable, with a total production cost of ₹1,08,794 per acre and a gross income of ₹2,14,821. The net income per acre was ₹1,06,027, and the Cost-Benefit Ratio was greater than one. This indicates that turmeric production was remunerative and profitable for cultivators in the Coimbatore district (Angles et al., 2011).

Karthik & Amarnath, (2014) reported from their study on an economic analysis of turmeric production in Tamil Nadu, India that the positive value of NPV, BCR of greater than one and IRR of more than current bank rate revealed the financial feasibility of turmeric processing unit (Kiruthika, 2013).

Papang & Tripathi, (2014) revealed from their study on costs and returns structure of turmeric in Jaintia district of Meghalaya that the average yield of fresh turmeric was 49 quintals per hectare, which dries down to approximately 14.7 quintals per hectare of semi-processed turmeric. Variable costs account for about 98 per cent of the total cost. The total cultivation cost (cost C2) was estimated at ₹77,012 per hectare. Net income is ₹6,475 per hectare for fresh turmeric and ₹28,109 per hectare for dried turmeric, with an additional ₹12,719 per hectare spent on post-harvest management.

Malik & Saraf, (2013) revealed major problems faced by Guava processors in Uttar Pradesh were non-availability of skilled labours, lack of adequate capital and high degree of competition, etc.

Sharma & Pandey, (2008) studied the costs and net profits from Guava processing in Uttar Pradesh in the year 2004-05. The cost of processing guava into jam and jellies per processing unit was estimated at ₹3,96,482 per year, the gross returns obtained from selling it was worked out to ₹5,28,750 per year and the net returns obtained were ₹32,268 per annum. It was observed that the processing of guava was more profitable than selling it raw (Osorio-Tobón et al., 2016).

Lokesh & Chandrakanth, (2004) studied on economics of production, marketing and processing of turmeric in Karnataka. They found that Karnataka was one of the major turmeric growing states and Chamarajanagar district produced 50 percent of the state's output. The net benefit cost ratio is 1.06 and 1.29 at price of ₹2,200 and ₹2,360 per quintal at a cost of production of ₹956 and ₹1,141 per quintal. The domestic value addition in turmeric was 48 percent because of increased domestic demand.

3. METHODOLOGY

Purposive random sampling technique was employed for the selection of turmeric processing units from two categories *viz.,* unorganized and organized as per proportions. The list of units under each category was prepared and finally, five units each from unorganized and organized sectors were randomly selected from Duggirala, Kollipara and Mangalagiri for the present study. Primary data were collected from the selected turmeric processing units through survey method with the aid of pre-tested schedule designed for the purpose. Secondary data regarding turmeric cultivation collected from authentic published

sources. The data collected pertains to the financial year 2023-2024 (Bhosale et al., 2020).

3.1 Net Present Worth (NPW)

It is sometimes referred to as net present value. It is the present worth of the incremental net benefits or incremental cash flow stream. The selection criterion of the project depends on the positive value of the net present worth when discounted at the opportunity cost of the capital.

Net present worth of the project (NPW) is estimated using the following formulae.

$$\mathrm{NPW}=\sum_{j=1}^{n}\frac{\mathrm{B_j}-C_j}{(1+i)^j}$$

Where,

B_j = Benefits in j^{th} year
C_j = Costs in j^{th} year
i = Discount rate
n = Number of year

3.2 Benefit-cost Ratio (BCR)

This ratio compares the present worth of costs with present worth of benefits. The common procedure of selecting the project is to choose the projects having the B:C ratio of more than one, discounted at opportunity cost of capital. This ratio was arrived by using the following formula.

$$BCR=\sum_{j=1}^{n}\frac{B_j/(1+i)^j}{C_j/(1+i)^j}$$

Where,

B_j = Benefits in rupees in j^{th} year
C_j = Costs in rupees in j^{th} year
i = Discount rate
n = Number of years

3.3 Internal Rate of Returns (IRR)

It represents the average earning capacity of an investment over the economic life period of the project. It is the discount rate at which the net present worth of cash flow equal to zero. In other words, the benefit cost ratio calculated at IRR is unity.

Mathematically it can be represented as,

Internal Rate of Return = Lower discount rate + Difference between higher and lower discount rates * {Net present worth at lower discount rate / Absolute difference between present worths at two discount rates}.

When the calculated IRR is greater than the market rate of interest, then the investment is considered viable.

3.4 Break-even Output and Break-Even Point

At break-even point the producer gets neither loss nor profit. To know the minimum level of turnover of a commercial turmeric processing units, break-even point in value terms and break-even output in physical terms were calculated.

The break-even output was calculated using the formula,

$$\text{Break-even output} = \frac{\text{Total fixed costs}}{\text{Selling price - Variable cost per unit}}$$

The break-even point is calculated using the following formula:

$$\text{Break-even point} = \frac{\text{Total fixed cost}}{1-\frac{\text{Variable cost per unit}}{\text{Selling price per unit}}}$$

3.5 Garrett Ranking Technique

The constraints of turmeric processing units were measured by applying Garrett ranking procedure. The order of merit given by the respondents were converted into rank by using the formula. To find out the most significant factor that associated with the respondent, Garrett's ranking technique was used. As per this method, respondents have been asked to assign the rank for all factors and the outcomes of such ranking have been converted into score value with the help of the following formula,

$$\text{Percent position} = \frac{100\left(\mathrm{R_{ij}}-0.5\right)}{N_j}$$

Where,

Rij = Rank given for the i^{th} variable by j^{th} respondents
Nj = Number of variables ranked by j^{th} respondents

4. RESULTS AND DISCUSSION

4.1 Economic Analysis of Turmeric Processing Units

The economic viability of turmeric processing units under different discount rates is assessed using Net Present Value (NPV) and Benefit-Cost (B:C) ratio in Table 1. At a 15% discount rate, unorganized units have an NPV of ₹66,54,326 with a B:C ratio of 1.29, whereas organized units show an NPV of ₹22,494,327 and a B:C ratio of 1.22. When the discount rate increases to 20%, unorganized units report an NPV of ₹4,758,673 with a B:C ratio of 1.27, while organized units have an NPV of ₹15,067,509 and a B:C ratio of 1.19. At the highest discount rate of 25%, unorganized units maintain an NPV of ₹34,10,671 with a B:C ratio of 1.24, whereas organized units achieve an NPV of ₹1,00,03,870 with a B:C ratio of 1.16.

Furthermore, the Internal Rate of Return (IRR) analysis highlights that unorganized turmeric processing units achieve a higher IRR of 58.24%, compared to 49.52% for organized units. This suggests that while both types of units are economically viable, unorganized units demonstrate higher short-term profitability, whereas organized units may benefit from better scalability and long-term financial stability.

Table 1. Economic viability of turmeric processing units under various scenarios utilizing the NPV (₹), B: C ratio and IRR

Particulars	Discount rates (%)		
Unorganized (n=5)	**15**	**20**	**25**
NPV (Rs.)	66,54,326	4,758,673	34,10,671
B-C Ratio	1.29	1.27	1.24
IRR (%)	58.24%		
Organized (n=5)			
NPV (Rs.)	22,494,327	15,067,509	1,00,03,870
B-C Ratio	1.22	1.19	1.16
IRR (%)	49.52%		

Table 2. Break even analysis for turmeric processing units

Particulars	Scale of Production	
	Unorganized (n=5)	**Organized (n=5)**
Processing Capacity	85 tonnes	250 tonnes
Price per tone	1,90,000	2,55,000
Variable cost per tone	1,46,583	2,19,097.65
Total fixed cost	**83,116**	**3,79,700**
Break even output (tonnes)	**1.91**	**10.57**
Breakeven point (₹)	**3,63,732**	**1,01,09,691**

Table 3. Constraints faced by turmeric processors

Particulars	Mean Score	Rank
Processing Constraints		
Price fluctuation	76.9	1
Fluctuations in procurement	70.1	2
Lack of Labour availability	65.1	3
Lack of Credit support	61.5	4
Lack of Storage facilities	52.5	5
Lack of skilled labour	46.5	6
Marketing Constraints		
More Intermediaries	86	1
Competition in the market	83	2
Demand Fluctuations	82	3
High Transportation cost	65	4

4.2 Break Even Analysis

The break even analysis showed that the overall break-even output was 1.91 tonnes in unorganized and 10.57 tonnes in organized units, while the actual production was 85 and 250 tonnes, indicating that the turmeric processing units in the study area were working at a level above the break-even output production. Break-even point was ₹3,63,732 (unorganized) and ₹1,01,09,691 (organized). The actual production under both the categories was significantly higher than the production level required to break even.

4.3 Constraints Faced by Turmeric Processors

The processing constraints were Price fluctuation was the first ranked constraint in turmeric processing units with mean score 77, followed by Fluctuations in procurement was ranked second with mean score 70, Lack of Labour availability was third ranked with mean score 65.1, Lack of access to credit was ranked fourth constraint with mean score 61.5, fifth major constraint was Inadequate storage facilities with mean score 52.5 and Lack of skilled labor was ranked sixth with mean score 46.5. The marketing constraints were More intermediaries was the first ranked constraint in turmeric processing units with mean score 86, followed by Competition in the market was ranked second with mean score 70, Demand Fluctuations was third ranked with mean score 82, High Transportation cost was ranked fourth constraint with mean score 65.

5. CONCLUSION

The cost-benefit analysis shows that organized units are more profitable, with higher gross returns per tonne (₹3,55,000) and net returns (₹1,21,255) compared to unorganized units (₹1,90,000 and ₹42,439, respectively). Economic viability indicators, such as Net Present Value (NPV), Benefit-Cost (B:C) ratio, and Internal Rate of Return (IRR), confirm profitability for both types of units. Break-even analysis indicates that organized units have a break-even output of 10.57 tonnes, much higher than unorganized units 1.91 tonnes, yet both operate well above these levels, with actual production at 250 tonnes for organized and 85 tonnes for unorganized units. This data underscores the profitability and economic feasibility of investing in turmeric processing units, particularly for larger, organized units. Turmeric processing units in Guntur district face several challenges, including price fluctuations (77%), procurement fluctuations (70%), and lack of labor availability (65%). Other constraints include limited access to credit, inadequate storage facilities, lack of skilled labor. Marketing challenges primarily involve numerous intermediaries (86%), market competition (83%), demand fluctuations (82%), and high transportation costs (65%).

Policy Implications:

1. There should be a minimum support price for turmeric as the instability of prices was the main reason for so many farmers to shift to other crops.
2. Turmeric oleoresin and essential oil extraction units should be established in and around the district to utilize domestic production and encourage farmers to grow the crop.
3. Exporters in the supply chain was critical for increasing the efficiency of supply chain in realization of better prices to the farmers through intensifying the competitions for quality produce among the buyers. The role of these players could be widened and encouraged through proper policy support.
4. Promote R&D initiatives in collaboration with agricultural universities and research institutes to innovate in processing techniques, product diversification, and packaging.
5. Introduce tailored insurance schemes to protect turmeric processing units against risks such as natural disasters, price volatility, and supply chain disruptions.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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