AN ECONOMETRIC ANALYSIS OF VALUE ADDITION IN CHILLY INDUSTRIES IN SOUTHERN TAMIL NADU

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ABSTRACT

The study was an attempt to estimate economics of chili powder and sauce production in major chilly marketing area in Southern Tamil Nadu. Further optimization technique was used to analyse the resource allocation in chillies industries. It was found that cost of production of chilli powder was Rs. 30.15/ pocket (200 gm/pocket) and the profit earned was estimated as Rs. 14.85 per pocket of chilli powder product. Whereas cost of production of chilli sauce was Rs. 31.02/ pocket (200 gm/pocket) and the profit earned was estimated as Rs. 8.98 per pocket of chilli sauce product. The establishment of rural chillies processing industry as a cooperative venture, covering about 1000 chillies growers (5-10 villages) was also found to be economically viable. The linear program analysis indicted that 47,945 Chillies powder pockets/year should be produced @ 160 pockets (200 gm pockets) per day. It fetched the gross income accounting for Rs.21.57 lakhs /year. Further It would save the chilly industry scarce resources towards effective supply chain optimization.

KEYWORDS: Supply Chain Optimization- Linear Programming- Chillies Processing Industry

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INTRODUCTION

India is popularly known as "Spice bowl of the world" and is the largest producer, consumer and exporter of spices. India is the world leader in chilli production followed by China, Thailand, Ethiopia and Indonesia. Indian chilli is considered to be world famous for two important commercial qualities of color and pungency levels. Indian chilli is mainly exported to Asian countries like Vietnam, Thailand, Sri Lanka, Bangladesh and U.A.E. In India, major chilli producing states are Andhra Pradesh, Telangana, Tamil Nadu, Karnataka and Madhya Pradesh. Red Chilli production for 2019-20 is estimated at 12.00 lakh MT compared to earlier estimate of 12.45 lakh MT, while previous year's production was 10.50 lakh. Currently, India is the main source of red chilli in the international market. It exports in different forms like chilli powder, dried chilli, pickled chillies and chilli oleoresins. In this background, an attempt has been made with the specific objectives: (i) to analyse economics of chilly powder and sauce production and (ii) to determine the optimal allocation of chilly industry scarce resources in Southern Tamil Nadu.

METHODOLOGY

In Southern Tamil Nadu, Virudhunagar district is known for Chillies industries. Hence three leading chillies industries producing value added products were purposively selected to collect data on Chillies industry scarce resources, production and marketing of Chillies products. The data were collected in person to estimate economics of chillies powder and sauce production and to estimate optimum resource allocation. In linear programming,

Simplex model was applied to determine the optimal allocation of scarce chillies industry resources.

Linear Programming Problem

Standard form is the usual and most intuitive form of describing a linear programming problem. It consists of the following three parts:

A Linear Function to be Maximized

e.g. maximize $c_1x_1 + c_2x_2$

Where maximize income from value addition in Chillies industry c_1 and c_2 are coefficients (price/unit)

x_1 and x_2 are Chillies powder and Chillies Sauce products

Problem constraints of the following form

$$a_{11}x_1 + a_{12}x_2 \leq b_1$$

$$a_{21}x_1 + a_{22}x_2 \leq b_2$$

$$a_{31}x_1 + a_{32}x_2 \leq b_3$$

where

a_{11} and a_{12} are human labour requirement/unit ;

a_{21} and a_{22} are capital requirement/unit

a_{31} and a_{32} are demand for respective products

b_1 b_2 and b_3 are resource available in the industry

Non-Negative Variables

e.g.

$$x_1 \geq 0$$

$$x_2 \geq 0$$

The problem is usually expressed in *matrix form*, and then becomes:

Maximize $\mathbf{c}^T \mathbf{x}$

Subject to

$$\mathbf{Ax} \leq \mathbf{b}, \mathbf{x} \geq 0$$

Where $\mathbf{x}$ represents the vector of variables (to be determined), $\mathbf{c}$ and $\mathbf{b}$ are vectors of (known) coefficients and $\mathbf{A}$ is a (known) matrix of coefficients. The expression to be maximized or minimized is called the objective function ($\mathbf{c}^T \mathbf{x}$ in this case). The equations $\mathbf{Ax} \leq \mathbf{b}$ are the constraints which specify a convex polytope over which the objective function is to be optimized.

RESULTS AND DISCUSSION

The study results were revealed that economics of value addition in chillies industry and optimization paved the way for better utilization of scarce resource in these industries. The results were discussed as follows:

Economics of Value Addition in Chillies Industry

The Economics of value addition in Chillies Industry was studied in two major value added products namely chillies powder and chillies sauce.

Economics of in Chillies Powder Production

The study was conducted to analyse economics of Chillies powder production and the results were discussed in table 1. Since the arrival of chillies was seasonal, the economics was worked out for 300 days/year. Economics of dry chillies powder production for the unit with a production capacity 160 pockets (200 gm/pocket) per day was estimated for 300 days per year. The initial investment expenditure was Rs. 16.55 lakhs for the above mentioned plant. The total fixed cost (operation and maintenance cost) was Rs. 2.53 lakhs for the processing plant. The total variable cost (running cost or production cost) was worked out as Rs. 11.39 lakhs. Here the value of dry chillies was arrived by multiplying the price during the peak arrival season and the total quantity of raw chillies materials used. The annual total cost of processing was Rs.14.47 lakhs. The gross return was estimated for production of chillies powder was Rs. 21.60 lakhs/year. Here the market price of dry chilli powder product was used as Rs. 45/pocket. It was further found that cost of production of chilli powder was Rs. 30.15/ pocket (200 gm/pocket). Further, the profit earned was estimated as Rs. 14.85per pocket of chilli powder product.

Table 1: Economics of in Chillies Powder and Sauce Production (160 pockets(200gms)/day for 300 days)
(in Lakh Rupees)

S. No.	Particulars	Chilli Powder	Chilli Sauce
I	Establishment of processing unit	Amount	Amount
1	Land and Building Value	10.000	10.000
	Cost of processing machines and accessories	5.500	5.500
	Office furniture and Fixtures	0.750	0.750
	Transport and installation charges	0.300	0.300
	Total establishment expenses	16.550	16.550
	Annual share of establishment cost	0.550	0.550
II.	Annual Processing Expenditure		
a.			
1	Cost of dry chillies	7.790	8.604
2	Labour charges (wages)	1.400	1.464
3	Cost of electricity, fuel and Water	0.250	0.275
4	Packaging materials and packing charges	0.800	0.975
5	Transport Charges	0.300	0.300
6	Marketing and advertising charges	0.200	0.200
7	Interest on working capital@12 percent	0.650	0.742
	Annual variable cost or running cost	11.390	12.360
	Annul variable cost or running cost (Rs./Pocket)	23.73	25.75
b.	Total Annual Fixed cost		
1	Salary of permanent staff	1.500	1.500
2	Maintenance cost of processing unit and building	0.100	0.100
3	Management cost	0.250	0.250
4	Building rental value	0.200	0.200
5	Depreciation on machineries	0.170	0.170

	6	Interest on fixed investment	0.310	0.310
		Total annual fixed cost	2.530	2.530
III.		Total annual processing cost (Annual share of Establishment cost + AFC + AVC)	14.470	14.890
		Production/year @ 160 pocket/day for 300 days (lakh pocket)	0.480	0.480
		Price/pocket (Rs./pocket)	45.000	40.000
		Gross income / year	21.600	19.200
		Profit / year	7.130	4.310
		Cost of production / pocket (Rs./pocket)	30.15	31.02
		Profit / pocket (Rs./pocket)	14.85	8.98

In nutshell, the establishment of rural chillies processing industry as a cooperative venture, covering about 1000 chillies growers (5-10 villages) was also found to be economically viable. Of the initial investment of Rs.16.55 lakh required for establishing the processing unit, Rs 6.55 lakhs may be contributed by 1000 farmers at the rate of Rs.655 per farmer for each hectare of chillies. The remaining 10 lakhs and the working capital requirements in the initial stages could be obtained from NABARD by submitting proper project proposals. Educating the farmers about the advantage of collective processing is very important to solicit their cooperation and NGOs could play a significant role in organizing the farmers.

Economics of in Chillies Sauce Production

The study was conducted to analyse economics of Chillies Sauce production and the results were discussed in the table 1. Since the arrival of chillies was seasonal, the economics was worked out for 300 days/year. Economics of dry chillies sauce production for the unit with a production capacity 160 pockets (200 gm/pocket) per day was estimated for 300 days per year. The initial investment expenditure was Rs. 16.55 lakhs for the above mentioned plant. The total fixed cost (operation and maintenance cost) was Rs. 2.53 lakhs for the processing plant. The total variable cost (running cost or production cost) was worked out as Rs. 12.36 lakhs. Here the value of dry chillies was arrived by multiplying the price during the peak arrival season and the total quantity of raw chillies materials used. The annual total cost of processing was Rs.14.89 lakhs. The gross return was estimated for production of chillies sauce was Rs. 19.20 lakhs/year. Here the market price of dry chilli sauce product was used as Rs. 40/pocket. It was further found that cost of production of chilli sauce was Rs. 31.02/ pocket (200 gm/pocket). Further, the profit earned was estimated as Rs. 8.98 per pocket of chilli sauce product.

Optimization by TORA

TORA software used in optimization problem. The variables uses are Chillies powder and Chillies Sauce and constraints used are human labour requirement/unit;capital requirement/unit and demand for respective products. The available resources are as resource constraint. The results shown Chillies powder production was only economical. Hence the software suggested to stop the Chillies sauce production. The linear programming indicted that 47,945 Chillies powder pockets/year should be produced @ 160 pockets (200 gm pockets) per day. It fetched the gross income accounting for Rs.21.57 lakhs /year .

CONCLUSIONS

It was inferred from the study that the initial investment expenditure in Chillies powder production was Rs. 16.55 lakhs. The annual total cost of processing was Rs.14.47 lakhs. The gross return was estimated for production of chillies powder was Rs. 21.60 lakhs/year. The annual total cost of processing was Rs.14.89 lakhs. The gross return was estimated for production of chillies sauce was Rs. 19.20 lakhs/year only. In optimization of the industry resources analysis, it was

inferred that 47,945 Chillies powder pockets/year should be produced @ 160 pockets(200 gm pockets) per day. It fetched the gross income accounting for Rs.21.57 lakhs /year. It was found that Chillies powder production was only economical. Hence the software suggested to stop the Chillies sauce production. Economic utilization of available resources would pave the way for supply chain optimization systems to ensure efficient utilization of resources and maximization of gross income. The establishment of rural chillies processing industry as a cooperative venture, covering about 1000 chillies growers (5-10 villages) was also found to be economically viable. This approach would be beneficial to the entrepreneurs by providing necessary profit and consumers by providing reasonable price.

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