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Quantification of the Benefit of Tomato Growers due to Intervention of Corporate Retail Industry in Agricultural Marketing: A Case Study in Ranga Reddy District of Andhra Pradesh

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ABSTRACT

An empirical research was conducted in Ranga Reddy district of Andhra Pradesh to ascertain the impact of corporate retail giants on agricultural marketing and for this purpose tomato growers of Ranga Reddy district were selected and the sample was divided into two subgroups based on the dealing with the retail sector. Cost of cultivation for first group farmers was amounted to an average of Rs. 36710.55 and for small, medium and large farms it was Rs. 40028.66, Rs. 35818.09 and Rs. 34234.98 respectively. Whereas for the second group, the cost of cultivation estimated was Rs. 37734.12 and for small, medium and large farms it was Rs. 43466.55, Rs. 35236.38 and Rs. 34499.53 respectively. From the discriminant function analysis used in the study it was concluded that 'net income' had relatively higher power in discriminating these two groups followed by cost of marketing and price received per each quintal
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Key words : Discriminant Function Analysis, Multiple Independent Variables, Single Index.

Perishable commodity marketing has its own history that the entire market transactions between seller-producers and buyer-consumers very much starts only at lower level in the marketing network and very much so in the vegetable marketing system (Kataria and Chahal 2007). The seller's market of vegetables will be seen with retail level selling only very much as it dominates the vegetables market because of high price volatility and perishability nature of vegetables. The recent trends do suggest that there is desirable profits as the profit margins would almost remain same in vegetable selling (Arora *et al*. 2007). Due to this fact, the vegetable vendors market has shifted from a mere traditional way of selling vegetables to commercial level of selling. It is very much evident with the drastic growth of vegetable selling points like Rythu bazaars sponsored by government and corporate body's selling points. This clearly explains that there is high magnitude of importance in vegetable marketing system. Keeping this in view, the present study has been planned to quantify the benefits of tomato growers due to intervention of corporate industry in vegetable marketing (Kumar, 2008).

The impact of a particular aspect on a particular person or group or on a society may be assessed through the most commonly used technique of comparing the event with and without. On these lines, an attempt was made to quantify the monetary benefits of retail sector on farmers within a limited geographical area by comparing two groups viz., one with retail sector (dealing with retail companies) and another group without retail sector (not dealing with retail companies) using appropriate statistical methods and finally the ultimate affect on farmers in monetary terms was revealed.

MATERIAL AND METHODS

The study aims at quantityting the impact of retail industry on tomato growers in the study area i.e Ranga Reddy district of Andhra Pradesh and the study was conducted during *rabi* 2008. The tomato growers in the study area were divided into two groups i.e group-I farmers deal with corporate retail companies and group-II farmers not deal with retail companies. Stratified random sampler method was used to select the respondents. From each group 21 farmers with equal no.of small, medium and large size farm growers were selected randomly to make the total sample of 42.

Discriminant function analysis

Discriminant function analysis was used to estimate the impact of corporate retail marketing on tomato growers. This test was employed to identify the variables that were important in discriminating between two groups of farmers. In multivariate analysis linear discriminant function was

better than any other linear function which discriminates between any two chosen classes. The concept underlying the discriminant function analysis was that linear combinations of independent variables were formed and serve as the basis for classification. Thus the information from multiple independent variables was summarized in a single index. For the application of linear discriminant function two groups of roughly equal size are required. For detecting the variables that allow to discriminate between two different (naturally occurring) groups, and for classifying cases into different groups with a better chance of accuracy.

RESULTS AND DISCUSSION

Cost of cultivation

Group-I:

Cost of cultivation of group-I was presented in table 1. The total cost of cultivation per hectare was amounted to Rs.36710.55 against Rs.40028.66, Rs.35818.09 and Rs.34234.98 for small, medium and large farms respectively. Total operational cost was ranged between Rs.21409.14 on medium farm and Rs.22702.24 on small farm and fixed cost was highest for small farms (Rs. 17326.42) and lowest for large farms (Rs. 12039.41).

Group-I:

Cost of cultivation of group-II was presented in table 2. The total cost of cultivation per hectare of tomato farm was amounted to Rs.37734.12 against Rs.43466.55, Rs.35236.38 and Rs.34499.53 for small, medium and large farms respectively. Operational cost was highest for small farms and lowest for medium farms.

Out of the total cost incurred in the cultivation of tomato by group-I farmers, operational costs contributed about 60.20 percent out of which human labour constituted about 28.82 per cent (table 3). Expenditure on tractor labour, seeds, manures and fertilizers, irrigation and plant protection incurred about 5.32 per cent, 1.49 per cent, 15.13 per cent, 1.15 per cent and 7.26 per cent respectively and interest on working capital incurred was 1.01 per cent. Fixed costs constitute 39.79 per cent of the total cost.

In case of group-II farmers the operational costs constitute about 61.26 per cent, out of which human labour constitute about 28.96 per cent followed by manures and fertilizers i.e about 16.79 per cent, remaining bullock/tractor labour, seeds, irrigation, plant protection and interest on working capital occupy about 5.58 per cent, 1.51 per cent, 1.09 per cent, 6.28 per cent and 1.02 per cent respectively. Fixed costs constitute about 38.73 per cent out of which 35.08 per cent constitute the rental value of own land.

Estimation of returns for both the groups of farmers

The cost of cultivation and yields were almost same for both the groups of farmers and there was a big difference in net income due to variation in marketing cost and average price received per each quintal by the respective farmers groups (table 4).

When two groups of farmers were compared based on costs and returns, the cost of cultivation and yields were almost same for both the groups of farmers. But the net returns obtained by the first group farmers were higher than the second group(Saraf and Mishra 1987). The main reason for high net returns in case of first group was the cost of marketing was quite low and price received per each quintal was higher than the open market price with the corporate body intervention(Lahar 1987).

Linear discriminant function

Linear discriminant function analysis was applied to know the relative importance of different variables, of their power to discriminate between two groups of farmers viz., suppliers to retailers and non suppliers to retailers.

The linear discriminant function employed was of the following form:

$$Z_1 = \sum_{i=1}^{p} L_i X_i \quad \text{(For the first group farmers)}$$

$$Z_2 = \sum_{i=1}^{p} L_i X_i \quad \text{(For the second group farmers)}$$

Where,

Z = Total discriminant score for both groups of farmers.

X_i = Variables selected to discriminate the two groups.

L_i = Linear discriminant coefficients of the variables estimated from the data.

The function was constructed by choosing values of Li s such that ratio:

$$= \frac{\text{Variation of 'Z' between the two groups}}{\text{Variation of 'Z' within the two groups}} \text{ was maximized}$$

Table 1. Cost of cultivation of tomato for first group farmers (Rupees/ha)

S.No	Particulars	Small	Medium	Large	All
1	OPERATIONAL COST				
	i.Human labour	11,229.81	10605.44	9911.86	10582.37
	Owned	5673.21	4325.45	3256.43	4418.36
	Hired	5556.60	6279.99	6655.43	6164.00
	ii.Bullock/tractor labour	2013.10	1942.21	1912.22	1955.84
	iii.Seeds	550.14	532.36	560.14	547.54
	iv.Manures and fertilizers	5560.00	5243.33	5865.10	5556.14
	v.Irrigation charges	440.05	419.19	408.07	422.43
	vi.Plant protection	2580.50	2306.20	3114.25	2666.98
	vii.Interest on working capital	328.64	360.41	423.93	370.99
	Sub total	22702.24	21409.14	22195.57	22102.28
2	FIXED COST				
	i.Rental value of owned land	15428.88	12833.18	10806.65	13039.57
	ii.Land revenue	150.61	126.41	138.50	138.50
	iii.Depreciation	541.56	468.70	438.58	482.94
	iv.Interest on fixed capital	1205.45	980.66	655.68	947.26
	Sub total	17326.42	14408.95	12039.41	14608.27
3	TOTAL	40028.66	35818.09	34234.98	36710.55

Table 2. Cost of cultivation of tomato for second group farmers (Rupees/ha)

S.No	Particulars	Small	Medium	Large	All
1	OPERATIONAL COST				
	i.Human labour	13608.00	9968.88	9211.68	10929.52
	Owned	6432.87	5445.42	2867.40	4915.23
	Hired	7175.13	4253.46	6344.28	5924.29
	ii.Bullock/tractor labour	2263.10	2142.05	1912.22	2105.79
	iii.Seeds	550.16	572.36	596.14	572.88
	iv.Manures and fertilizers	6300.05	6112.25	6596.14	6336.14
	v.Irrigation charges	469.04	362.42	410.07	413.84
	vi.Plant protection	2414.51	1982.42	2718.93	2371.95
	vii.Interest on working capital	378.46	368.41	413.93	386.93
	Sub total	25983.32	21508.79	21859.11	23117.05
2	FIXED COST				
	i.Rental value of owned land	15824.88	12383.18	11506.56	13238.20
	ii.Land revenue	78.25	68.34	72.60	73.06
	iii.Depreciation	424.45	328.41	340.58	364.48
	iv.Interest on fixed capital	1155.65	947.66	720.68	941.33
	Sub total	17483.23	13727.59	12640.42	14617.07
3	TOTAL	43466.55	35236.38	34499.53	37734.12

Table 3. Comparison of cost of cultivation of both the groups: (In percentages)

S.No	Particulars	First group farmers (%)	Second group farmers (%)
1	OPERATIONAL COST		
	i.Human labour	28.82	28.96
	Owned	12.03	13.02
	Hired	16.79	15.70
	ii.Bullock/tractor labour	5.32	5.58
	iii.Seeds	1.49	1.51
	iv.Manures and fertilizers	15.13	16.79
	v.Irrigation charges	1.15	1.09
	vi.Plant protection	7.26	6.28
	vii.Interest on working capital	1.01	1.02
	Sub total	60.20	61.26
2	FIXED COST		
	i.Rental value of owned land	35.51	35.08
	ii.Land revenue	0.37	0.19
	iii.Depreciation	1.31	0.96
	iv.Interest on fixed capital	2.58	2.49
	Sub total	39.79	38.73
3	TOTAL	100	100

Table 4. Returns for both the groups of tomato farmers.

S.No	Particulars	First group farmers	Second group farmers
1	Cost of cultivation (in Rs)	36710.55	37734.12
	Cost of marketing (in Rs)	2168.96	7118.47
	Total costs (in Rs)	38879.51	44852.59
2	Yield Q/ha	175.33	182.62
	Price received per quintal (in Rs)	385.50	329.16
	Gross income (in Rs)	67589.71	60111.19
3	Net income (in Rs)	28710.20	15258.60

i.e. $f(L1, L2, L3, \ldots LP) = \dfrac{n1\ n2\ (L1d1 + L2d2 + \ldots\ldots + LPdP)^2}{n1 + n2 \sum_{i=1}^{p} \sum_{i=1}^{n} S1J\ Li\ Lj}$

Where,

d = d1, d2,……dp was the vector of mean differences on the 'p' original measures.

S = within groups co-variance matrix

S L = d

Where,

L = Column vector of the coefficient of discriminant function.

S = Pooled dispersion matrix Sij (pooled covariance matrix of the same groups)

d = Column vector of difference between the mean values of different variables for the two groups i.e.

$$\begin{matrix} S\,1\,1 & S\,1\,2 & \ldots\ldots\ldots\ldots & S\,1P & L\,1 \\ S\,2\,1 & S\,2\,2 & \ldots\ldots\ldots\ldots & S\,2\,P & L\,2 \\ S\,n\,1 & S\,n\,2 & \ldots\ldots\ldots\ldots & S\,n\,P & L\,n \end{matrix} = \begin{matrix} d\,1 \\ d\,2 \\ d\,n \end{matrix}$$

The equation can be rewritten as:

L1S11 + L2S12 +……..Ln S1P = d 1

L1S21 + L2S22 +……..Ln S2P = d 2

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L1Sn1 + L2Sn2 +……Ln Snp = dn

The discriminant function was tested for significance, whether the variables considered together were significantly discriminating between the two groups. Mahalanobis D^2 statistics was used to measure the discriminating distance between the two groups:

$$D^2ab = (n-g) \sum_{i=1}^{p} \sum_{i=1}^{n} w\,ij\ (Xia-Xib)\ (Xja-Xjb) = \sum_{i=1}^{n} Lidi$$

Where, n = total no.of cases

g = no.of groups

p = no.of variables

Xia = Mean of i^{th} variable in group 'a'

Wij = Element from the inverse of within groups covariance matrix.

Li = Inverted matrix of the coefficients of the discriminant function.

a = suppliers b = non suppliers

The significance of D^2 as tested by applying the following F-test

$$F = \frac{n1\ n2\ (n1+ n2 -p -1)}{(n1 + n2)\ (n1 + n2 - 2)} D^2$$

Where, p = no.of variables

n_1 = no.of farmers in the first group

n_2 = no.of farmers in the second group

$$D^2 = (\overline{X1} - \overline{X2})'\ S^{-1}\ (\overline{X1} - \overline{X2})$$

S = Pooled covariance matrix of the two samples

The 'Z' scores for each group may be calculated as:

$Z1 = \sum_{i=1}^{p} Li\ Xi$ (For first group farmers)

$Z2 = \sum_{i=1}^{p} Li\ Xi$ (For second group farmers)

The critical mean discriminant score was obtained as $\overline{Z} = [Z1+Z2] / 2$

For each individual, Zi value was calculated by $Zi = \sum_{i=1}^{p} Li\ Xi$

If the individual Zi values are more than $\overline{Z}$, the individual belongs to first group otherwise second group.

Results of discriminant function analysis for both the groups of farmers

The picture of the linear discriminant analysis for both the groups of farmers was presented in table 5. It was observed that the mean difference, out of nine identified variables, five variables were negative and four variables were positive. The discriminant coefficient of nine variables viz. education, cost of cultivation, cost of marketing, price received per quintal, net income, age of farmer, family size, human labour and interest on fixed capital were - 0.143, 0.000, - 0.003, 0.135, 0.001, - 0.075, 0.015, 0.000, - 0.024 respectively. The contribution of education, cost of cultivation, family size and interest on fixed capital was negative to the total distance and the rest of variables. viz., cost of marketing, price received per quintal, net income, age of farmer and human labour were contributed positively to the total distance. The estimated discriminant function for both the groups of farmers was shown in table 5. From table 5,

Table 5. Discriminant function analysis results.

S.No	Variable	Mean difference (di)	Discriminant coefficient (Li)	Li X di	% contribution to the total distance
1.	Education	1.429	- 0.143	- 0.204781	- 0.5952
2.	Cost of cultivation	- 1023.598	0.000	- 0.001689	- 0.0049
3.	Cost of marketing	- 4463.932	- 0.003	12.217784	35.5165
4.	Price received per quintal	52.370	0.135	7.086222	20.5993
5.	Net income	13451.643	0.001	15.119390	43.9513
6.	Age of farmer	- 1.857	- 0.075	0.140209	0.4075
7.	Family size	- 0.143	0.015	- 0.002204	- 0.0064
8.	Human labour	- 418.519	0.000	0.189584	0.5511
9.	Interest on fixed capital	5.917	- 0.024	- 0.144223	- 0.4192
				34.400290	100.000

D^2 = 34.400290

**Significance at 5% level of probability

Z_1 = 46.91215294,

Z_2 = 12.51186271 and Z = 29.71200782

$Z = - 0.143X_1 + 0.000X_2 - 0.003X_3 + 0.135X_4 + 0.001X_5 - 0.075X_6 + 0.015X_7 + 0.000X_8 - 0.024X_9$

D^2 value (34.400290) was found significant at five percent level of probability indicating seven variables out of nine variables considered in the function were useful in distinguishing the two groups of farmers.

The relative importance of the discriminators was calculated through their percent contribution to total distance. It was revealed from the table that the net income obtained was the major discriminator (43.95 percent) followed by the cost of marketing. The other variables like price received per quintal, human labour, age of farmers, cost of cultivation, family size, interest on fixed capital, education contributed 20.599, 0.5511, 0.4075, -0.0049, - 0.0064, - 0.419, - 0.5952 respectively to total distance.

CONCLUSION

In the present study, net income had relatively higher power in discriminating between the two groups by contributing about 43.95 percent to the total distance. The D^2 value was 34.40 and it was significant at five percent level of probability. The mean Z score value observed was 29.71. The other factors which discriminate these two groups were cost of marketing, price received per quintal, age of farmers and human labour to the extent of 35.51 percent, 20.59 percent, 0.40 percent, and 0.55 percent respectively. Remaining variables contributed negatively.

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