

Impact of Marketing Information System (MIS) on Prices Realization of Minor Forest Produce (MFP) in High Altitude and Tribal (HAT) Zone of Andhra Pradesh

ABSTRACT

This study mainly focused on impact of MIS on prices realization of selected minor forest produce (MFP) viz., honey, hill broom, naramamidi bark, seeded tamarind, marking nut and myrobalan. Propensity Score Matching (PSM) technique was employed to analyse impact of market information on price realization of MFP. Primary data was collected from 360 farmer respondents from HAT zone in Andhra Pradesh state. The probit regression results indicated that considered variables has positive significant association and influenced to access market information in the study viz., experience, frequency of visit to Girijan Primary Co-operative Marketing Society (GPCMS), access to mobile phone, education and trainings on the importance of MIS in accessing market information from GPCMS and Primary Procurement Centres (PPCs). Access to market information by the tribal farmers revealed significant impact ($P < 0.001$) on treated, as the impact indicator (prices) is higher for them compared to untreated. The treated were significantly benefited from market information by 15.19 per cent for honey, 37.95 per cent for hill broom and 89.16 per cent for naramamidi bark, 60.27 per cent for seeded tamarind, 115.45 per cent for markingnut and 133.34 per cent for myrobalan.

Key words: MIS, MFP, probit regression, HAT zone and Propensity Score Matching

1. INTRODUCTION

Indian MFP markets are characterized by a myriad of sellers, where few number of buyers, latter of who are placed at a relative advantage in terms of information awareness. The limits on flow of information from the sellers are unintentional, whereas intentional flow of market information from the demand side helps in artificially manipulating the market price in their favour. Such kind of unintelligible market structures creates unfavourable situations to collectors and

cultivators, it reflects to unsustainable harvesting of the MFP in the absence of accurate market information about market demand and price of MFP. The institutional and non-institutional organizations that make effort to help the MFP cultivators and collectors are also severely inhibited by the lack of reliable and accurate market data. The MFP collector's access to consumers was limited to sales made in local weekly shandies. In India, the sale of the MFP adopted by local tribes without any significant processing or value addition activities. Tribal farmers sold major portion of their collected MFP to intermediaries like local commission agents and petty traders. The existed market locations are also geographically limited in tribal areas. Narrow quantity of MFP collection further provoke the problem, forcing the local tribal population into a vicious circle of inferior market, low production and which led to slender marketable surplus. Minute quantity of marketable surplus makes tribal population more vulnerable and it causes exploitation because it continuously erodes their bargaining capacity in transacting of MFP. Consequential to the market imperfections are the unavailability of information at the right time to the needy stakeholders and obstacles in the path of commercial exploitation of MFP in a sustainable manner. In India, dishearten to say that availability of reliable market data continues to be an issue; even the statistics for demand, supply and trade related to timber, which is a major produce from the forests, are not reliable and accurate (ITTO, 2003). In similarly there is non-availability of reliable statistical data statistics on MFP. In HAT zone of Andhra Pradesh, the important sources of marketing information for farmers and other stakeholders include, display boards at PPCs, newspapers, radio, television, mobile phones and magazines *etc.*, and these enable the farmers to take right decisions at right time for collection and transacting their MFP. Present study focused on impact of MIS on price realization of selected MFP across accessed and non-accessed of tribal farmers.

2. DATA AND METHODOLOGY

For the present study primary data was collected with help of multi-stage sampling design *i.e.* Division level, GPCMS level and shandy level in the period of 2020-21. The tribal farmers generally transact their MFP in shandies, where they

transact the produce to either GPCMS or private traders or both depending upon the relative prices offered by these two market players. So, accordingly, two samples were drawn for each MFP transacted by the tribal farmer. Twenty four sample farmers per each Division under GCC who transact selected MFP with GPCMS and again 12 sample farmers/shandy who transact MFP with private traders per each Division under GCC were selected randomly. Thus, 120 farmers from 10 GPCMS (across five Divisions) and 240 farmers from 20 shandies were selected. So, in total, five Divisions of GCC, 10 GPCMSs, 20 shandies and 360 sample farmers (120 sample farmers transacted produce to GPCMS/PPCs and 240 sample farmers transacted produce to private traders in shandies) were selected for this in depth investigation.

2.1 Tool for impact of MIS on price realization

At the first stage, two sampling frames from HAT zone were collected comprising the list of farmers transacting MFP through market information received from PCCs/GPCMS (treated, n = 120) vis-à-vis farmers transacting MFP in shandies collecting market information from unofficial (private) sources viz., co-farmers, traders in shandies, friends, relatives *etc.* (untreated, n = 240). Thus, the farmers in this zone were stratified into treated and untreated based on the access to market information from GPCMS officials. Thus, a representative sample of 360 farmers (comprising of 120 treated and 240 untreated) are selected from HAT zone. Across the selected MFP, the selected treated and untreated categories of farmers are given in Table 1.

Table1. Sample distribution across selected MFP

Name of MFP	Treated farmers	Untreated farmers
Hill broom	61	178
Honey	71	203
Marking nut	64	187
Myrobalan	70	196
Naramamidi bark	61	181
Seeded tamarind	69	189

PSM technique was employed to analyze the impact of MIS on prices realized for selected MFP transacted by tribal farmers. In this technique, each farmer of treated category is matched with the farmer of untreated category based on the observable

covariates (Table 2). This will facilitate to assign the treatment randomly across the two categories to analyze the average differences in prices. The PSM can be expressed as:

$$p(X) = \Pr [D = 1|X] = E[D|X]; p(X) = F\{h(X_i)\}, \quad (1)$$

where $p(X)$ is a propensity score and \Pr is the probability of receiving market information (treated farmer will receive the value of ‘1’, and ‘0’ otherwise) conditional on the vector of covariates mentioned earlier. Probit model (Equation 2) was employed to estimate the predicted probabilities (propensity scores) of receiving market information (Greene, 2003; Verbeek, 2008; Willy *et al.* 2014):

$$\Pr(D = 1|X) = G(z) = \int_{-\infty}^{X'\beta} \phi(z) dz = \Phi(X'\beta) \quad (2)$$

where, $G(z)$ is a function taking values between 0 and 1, ϕ is the standard normal probability density function, z is the vector of covariates and Φ is the standard normal cumulative distribution function.

Table 2. Variable types and definitions for PSM

Variable type	Abbreviation	Variable definition	Variable type
Outcome Variable	Price (Rs/kg)	Price realized for MFP (Rs/kg)	Continuous
Treatment variable	Source of market information	Access to market information collected by the farmers from PPCs/GPMCS in transacting selected MFP/	Dummy (1=Yes, 0 =No)
Covariates	DTM	Distance to PPC/shandy from point of collection of MFP (km)	Continuous
	EXP	Experience in transacting MFP (years)	Continuous
	FREQ	Frequency of visits to PPC or shandy	Quantitative variable (number)
	AMP	Access to mobile phone	Dummy (1=Yes, 0=No)
	TRG	Trainings received on MIS	Dummy (1=Yes, 0=No)
	EDU	Education status of tribal farmer	Dummy (1=Yes, 0=No)

The computed probabilities are used for matching treated and untreated categories of farmers by employing three matching algorithms (Samuel and Beza, 2019) *viz.*, Nearest Neighbour Matching (NNM), Kernel-Based Matching (KBM) and Radius Matching (RM). From these matching methods, Average Treatment effect on

the Treated (ATT) was computed. Further, Rosenbaum bound test was computed to analyze the sensitivity of the estimated ATT to unobserved confounders (Rosenbaum, 2002 and Rosenbaum and Rubin, 1983).

3. RESULTS AND DISCUSSION

PSM technique was employed to know the impact of MIS on price realization of selected MFP across treated and untreated categories of farmers. STATA 13 software used to analyse PSM for selected MFP and are given in Table 3.

Table 3. Number of matched pairs across treated and untreated categories of farmers transacting selected MFP

MFP	Treated farmers	Untreated farmers	Matched Pairs
Hill broom	61	178	n = 61 matched pairs
Honey	71	203	n = 71 matched pairs
Marking nut	64	187	n = 64 matched pairs
Myrobalan	70	196	n = 70 matched pairs
Naramamidi bark	61	181	n = 61 matched pairs
Seeded tamarind	69	189	n = 69 matched pairs

Source: Field survey

The results obtained from the probit analysis and the variables that used in the matching procedures are reported in Table 4. Results explained that, there is a positive and significant association between the selected variables *viz.*, frequency of visit (FREQ) to GPCMS, experience (EXP), trainings (TRG) on the importance of MIS in accessing market information from respect GPCMS and PPCs in the study area. The ‘experience (EXP)’ of tribal farmers in transacting MFP and their frequent visits (FREQ) to shandies/PPCs enabled them to gain good access to PPC/GPCMS officials for useful and timely market information for selling the MFP through at higher prices. This finding is in line with the findings of (World Bank 2007) that experience and skills are the fundamental factors in commercializing the Agriculture. Further, the trainings (TRG) received by the tribal farmers through GPCMS officials enabled them to gain knowledge about various level of sources of market information and their importance for transacting MFP timely in the market. The marginal effects of ‘EXP’, ‘FREQ’ and ‘TRG’ revealed that the shift from lack of these factors would enhance

the probability of access to market information from GPCMS/PPCs with regard to transactions of all the selected MFP.

Further, farmers who enjoy access to mobile phone (AMP) in the study area are receiving market information from time to time with respect to minimum, maximum and modal prices, grading standards *etc.*, and hence, exerted positive and significant influences on the access to market information from GPCMS/PPCs regarding prices of naramamidi bark, honey and seeded tamarind. Similarly, the education background (EDU) of tribal farmers has contributed positively in accessing marketing information with respect to honey, hill broom, seeded tamarind and naramamidi bark. However, ‘distance to market (DTM)’ has exerted significant negative influence on the access to market information from GPCMS/PPCs in transacting myrobalan and marking nut due to higher transaction costs. Thus, the findings suggest that importance of all the explanatory variables in influencing the farmers to accessing market information from GPCMS and PPCs in the HAT zone.

Table 4. Marginal effects for determinants of access to market information

Variables	Hill broom	Honey	Marking nut	Myrobalan	Naramaidi bark	Seeded tamarind
DTM	-0.0114	0.2386	-0.2385**	-0.198*	-0.0269	-0.1299
EXP	0.0244**	0.0375**	0.0299*	0.0371**	0.0353**	0.0388**
FREQ	0.8764**	0.2756*	0.4488**	0.5014**	0.4055**	0.3954**
AMP	0.2095	0.397**	0.1297	0.3467	0.2679**	0.3421**
TRG	0.7964*	0.7049*	0.6062*	0.2331*	0.4143*	0.1299*
EDU	0.7227**	0.4347*	0.1912	0.3094	0.7508**	0.4561**
Constant	2.0401	1.7502	1.148	2.0621	2.5768	2.0278
Pseudo R ²	0.2429	0.1832	0.2176	0.2369	0.3106	0.2863

Note: ** & * indicates significance at 1 and 5 percent probability levels respectively

Raw Data Source: Field Survey

a. Estimation of ATT - Matching Algorithms: The empirical results of the impact of market information received from PPCs/GPCMS on the prices of selected MFP are presented through Tables 5 to 8 by employing NNM, KBM and RM methods. All the results were based on implementation of common support and caliper, so that the distributions of treated and untreated were located in the same domain. As suggested by (Rosenbaum and Rubin, 1983) a caliper size of one-quarter of the Standardized

Difference (SD) of the propensity scores was used. Bootstrap standard errors based on 100 replications are reported.

It was found from the results that the market information received from GPCMS has exerted positive and significant impact on prices of selected MFP for treated compared to untreated counterpart. This indicates the average change in value of the outcome brought about by the MIS of GPCMS. The ATT of the market information on prices was around Rs. 44.05 for hill broom, Rs. 165.88 for honey, Rs.15.19 for markingnut, Rs.17.09 for myrobalan, Rs.27.16 for naramamidi bark and Rs.41.66 for seeded tamarind (average of three matching methods). However, picking any farmer at random, the Average Treatment Effect (ATE) was found to be Rs. 4.30 for hill broom, Rs. 9.79 for honey, Rs.8.92 for markingnut, Rs.7.95 for myrobalan, Rs.12.35 for naramamidi bark and Rs.5.22 for seeded tamarind (average of three matching methods). This implies that if any tribal farmer in the sample enjoys access to market information from GPCMS (treated), he/she will realize higher prices for all the selected MFP compared to untreated counterpart.

Thus, the access to market information by the tribal farmers revealed significant impact ($P < 0.001$) on treated, as the impact indicator (prices) is higher for them compared to untreated. The treated were significantly benefited from this technology by 37.95 per cent for hill broom, 15.19 per cent for honey, 115.45 per cent for markingnut, 133.34 per cent for myrobalan, 89.16 per cent for naramamidi bark and 60.27 per cent for seeded tamarind (average of three matching methods) compared to untreated. This clearly indicates to strengthen MIS in the study area, as for all the selected MFP, the treated are enjoying higher prices compared to untreated, especially for markingnut and myrobalan. This result corroborates with the findings of (Wordofa *et al.* 2021) that adoption of improved Agricultural technology had a strong and significant impact on household income in eastern Ethiopia.

Table 5. Average impact estimates of PSM (NNM) on prices of selected MFP

MFP	Sample	Treated	Control	Difference	SE	t-stat
Hill broom (n = 61 matched pairs)	Unmatched	44.6	26.49	18.11	1.09	16.52
	ATT	44.6	33.28	11.32	3.76	3.01**
	ATU	26.48	12.88	13.60	.	
	ATE			9.94	.	
Honey (n = 71 matched pairs)	Unmatched	164.82	134.47	30.35	1.87	16.21
	ATT	164.82	143.3	21.52	8.8	2.45**
	ATU	134.44	113.68	20.76	.	
	ATE			15.02	.	
Marking nut (n = 64 matched pairs)	Unmatched	15.34	7.97	7.37	0.49	14.86
	ATT	15.34	7.42	7.92	1.26	6.29**
	ATU	7.92	-3.6	11.52	.	
	ATE			10.44	.	
Myrobalan (n = 70 matched pairs)	Unmatched	16.94	7.21	9.73	0.61	15.97
	ATT	16.94	7.31	9.63	1.34	7.19**
	ATU	7.16	4.07	3.09	.	
	ATE			5.02	.	
Naramamidi bark (n = 61 matched pairs)	Unmatched	27.13	15.76	11.37	0.77	14.75
	ATT	27.13	15.32	11.81	2.14	5.52**
	ATU	15.72	6.06	9.66	.	
	ATE			10.29	.	
Seeded tamarind (n = 69 matched pairs)	Unmatched	41.01	26.5	14.51	1.15	12.62
	ATT	41.01	25.38	15.63	4.79	3.26**
	ATU	26.48	3.56	22.92	.	
	ATE			15.41	.	

Note: *** indicates significant at 1 per cent

Table 6. Average impact estimates of PSM (KBM) on prices of selected MFP

MFP	Sample	Treated	Control	Difference	SE	t-stat
Hill broom (n = 61 matched pairs)	Unmatched	44.62	26.48	18.11	1.09	16.61
	ATT	44.16	32.47	11.69	4.81	2.43**
	ATU	36.81	42.68	5.87	.	
	ATE			1.9	.	
Honey (n = 71 matched pairs)	Unmatched	164.83	134.44	30.35	1.87	16.23
	ATT	166.94	141.78	25.16	7.74	3.25**
	ATU	149.54	159.64	10.09	.	
	ATE			7.85	.	
Marking nut (n = 64 matched pairs)	Unmatched	15.34	7.92	7.37	0.49	15.04
	ATT	15.01	6.77	8.24	1.26	6.54**
	ATU	7.27	15.01	7.73	.	
	ATE			8.13	.	
Myrobalan (n = 70 matched pairs)	Unmatched	16.91	7.16	9.73	0.6	16.22
	ATT	17.36	7.3	10.06	1.4	7.19**
	ATU	7.27	15.21	7.94	.	
	ATE			9.56	.	
Naramamidi bark	Unmatched	27.11	15.72	11.37	0.77	14.77
	ATT	27.22	13.84	13.38	2.09	6.40**

(n = 61 matched pairs)	ATU	15.03	28.67	13.67	.	
	ATE			13.45	.	
Seeded tamarind (n = 69 matched pairs)	Unmatched	41.12	26.48	14.51	1.15	12.62
	ATT	42.36	26.69	15.67	4.85	3.23**
	ATU	36.81	42.39	5.58	.	
	ATE			0.45	.	

Note: *** indicates significant at 1 per cent

Table 7. Average impact estimates of PSM (RM) on ‘Prices’ of selected MFP

MFP	Sample	Treated	Control	Difference	SE	t-stat
Hill broom (n = 61 matched pairs)	Unmatched	44.63	26.48	18.11	1.09	16.61
	ATT	43.39	30.17	13.22	3.85	3.43**
	ATU	38.88	42.59	3.7	.	
	ATE			1.07	.	
Honey (n = 71 matched pairs)	Unmatched	164.82	134.44	30.35	1.87	16.23
	ATT	165.89	147.07	18.82	5.1	3.69**
	ATU	152.22	160.82	8.59	.	
	ATE			6.49	.	
Marking nut (n = 64 matched pairs)	Unmatched	15.34	7.92	7.37	0.49	15.04
	ATT	15.21	6.98	8.23	1.3	6.33**
	ATU	7.22	15.27	8.05	.	
	ATE			8.18	.	
Myrobalan (n = 70 matched pairs)	Unmatched	16.91	7.16	9.73	0.6	16.22
	ATT	16.96	7.36	9.6	1.5	6.40**
	ATU	7.22	15.46	8.24	.	
	ATE			9.27	.	
Naramamidi bark (n = 61 matched pairs)	Unmatched	27.12	15.72	11.37	0.77	14.77
	ATT	27.14	14.01	13.13	2.17	6.05**
	ATU	14.44	28.31	13.87	.	
	ATE			13.31	.	
Seeded tamarind (n = 69 matched pairs)	Unmatched	41.04	26.483	14.51	1.15	12.62
	ATT	41.6	25.92	15.68	4.93	3.18**
	ATU	38.88	42.86	3.97	.	
	ATE			-0.215	.	

Note: *** indicates significant at 1 per cent

b. Rosenbaum sensitivity test: This test was employed to know, whether the results of PSM are robust to unobservable or confounding variables. Since the outcome variable, ‘price’ is continuous in nature, Hodges-Lehmann point estimates were computed (Watkins *et al*, 2014). The findings from Table 4.26 revealed that the outcome variable still remained significant at different levels of Gamma and this implied that the estimated outcome is robust to unobserved characteristics (Becker & Ichino, 2002; Rosenbaum, 2002 and Rosenbaum and Rubin, 1983).

Table 8. Rosenbaum sensitivity test for upper bound significance level

MFP	Gamma*	Significance level		Hodges-Lehmann point estimate		Confidence interval (95%)	
		Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound
Hill broom (n = 61 matched pairs)	$\Gamma = 1$	5.4e-10	5.4e-10	12.50	12.50	10.00	15.00
	$\Gamma = 2$	8.1e-06	0.0000	10.00	15.00	7.50	17.50
	$\Gamma = 3$	0.0003	0.0000	7.50	15.00	5.00	17.50
	$\Gamma = 4$	0.0014	0.0000	7.50	17.50	5.00	20.00
	$\Gamma = 5$	0.0037	0.0000	7.50	17.50	2.50	20.00
Honey (n = 71 matched pairs)	$\Gamma = 1$	5.5e-10	5.5e-10	12.50	12.50	12.00	15.00
	$\Gamma = 2$	8.2e-06	0.0000	8.50	12.50	5.00	11.50
	$\Gamma = 3$	0.0002	0.0000	7.50	12.50	5.00	15.00
	$\Gamma = 4$	0.0015	0.0000	5.00	12.50	5.00	15.00
	$\Gamma = 5$	0.0034	0.0000	5.00	12.50	2.50	20.00
Marking nut (n = 64 matched pairs)	$\Gamma = 1$	4.6e-10	4.6e-10	7.50	7.50	7.50	10.00
	$\Gamma = 2$	7.5e-06	0.0000	7.50	10.00	5.00	10.00
	$\Gamma = 3$	0.0002	0.0000	5.00	10.00	5.00	12.50
	$\Gamma = 4$	0.0011	0.0000	5.00	10.00	2.50	12.50
	$\Gamma = 5$	0.0030	0.0000	5.00	12.50	2.50	12.50
Myrobalan (n = 70 matched pairs)	$\Gamma = 1$	5.3e-10	5.3e-10	10.00	10.00	7.50	10.00
	$\Gamma = 2$	8.0e-06	0.0000	7.50	12.50	5.00	12.50
	$\Gamma = 3$	0.0002	0.0000	7.50	12.50	5.00	15.00
	$\Gamma = 4$	0.0011	0.0000	5.00	12.50	2.50	15.00
	$\Gamma = 5$	0.0031	0.0000	5.00	12.50	2.50	17.50
Naramamidi bark (n = 61 matched pairs)	$\Gamma = 1$	5.6e-10	5.6e-10	12.50	12.50	10.00	15.00
	$\Gamma = 2$	8.3e-06	0.0000	10.00	15.00	7.50	17.50
	$\Gamma = 3$	0.0002	0.0000	7.50	15.00	5.00	17.50
	$\Gamma = 4$	0.0011	0.0000	7.50	17.50	5.00	20.00
	$\Gamma = 5$	0.0032	0.0000	7.50	17.50	2.50	20.00
Seeded tamarind (n = 69 matched pairs)	$\Gamma = 1$	5.3e-10	5.3e-10	10.50	10.50	7.50	12.00
	$\Gamma = 2$	7.5e-06	0.0000	7.50	10.00	7.50	15.00
	$\Gamma = 3$	0.0002	0.0000	5.00	10.00	5.00	12.50
	$\Gamma = 4$	0.0013	0.0000	5.00	10.00	2.50	12.50
	$\Gamma = 5$	0.0030	0.0000	5.00	12.50	2.50	12.50

Note: * - Gamma - log odds of differential assignment due to unobserved factors

4. CONCLUSIONS

Most of the explanatory variables in the study are influencing the farmers to accessing market information from GPCMS and PPCs in the HAT zone and there is a positive significant association between the selected variables *viz.*, frequency of visit to GPCMS, experience, trainings on the importance of MIS in accessing market information from respect GPCMS and PPCs. The market information received from GPCMS has exerted positive and significant impact on prices of selected MFP for treated compared to untreated counterpart. This result clearly explains importance of

strengthening MIS to fetching higher market price for MFP of tribal farmers in HAT zone of Andhra Pradesh.

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