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Innovations in agricultural marketing: a case study of e-tendering system in Karnataka, India

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Abstract This paper analyses the effectiveness and challenges of e-tendering marketing system with a focus on pigeon pea. The results indicate that e-tendering has been successful in reducing transaction time, bringing transparency in price discovery and increasing market revenue, besides enhancing market competition. The system, however, has not been effectively implemented among all the markets because of traders' resistance. By identifying the factors behind the success of e-tendering in some markets and the lack thereof in others, we provide certain key insights into obstacles in successful implementation of innovative marketing reforms with specific reference to the e-National Agricultural Market (e-NAM).

Keywords E-tendering, Unified market platform, Market integration, Transaction cost, e-NAM

JEL classification Q1, Q13, Q18

1 Introduction

Agricultural markets in India are underdeveloped and imperfect, and lack both horizontal as well as vertical integration. The supply chains for agricultural commodities are long and dominated by a number of intermediaries, leading to a considerable price spread from their point of production to end-consumption. In other words, there exists inefficiency in agricultural marketing system. According to Chand (2012), the transfer of farm produce to end-consumers involves at least four intermediaries without adding any value to the produce. This reduces producers' share in consumer's rupee, especially in case of perishable commodities. Price discovery is not transparent and under-pricing is quite common. Lack of infrastructure, grading and adequate standards is another major problem. Only about 7% of the marketed surplus is graded at farm level (Chand 2012). Multiple taxes, market fees and multiple licensing systems have added to the complexities of the agricultural marketing, besides increasing the transaction costs (Patnaik 2011; GoI 2013).

In order to improve marketing efficiency or transparency, the Government of India amended the Agricultural Produce Market Committee Act (Model APMC act 2003) that provides for direct sale of farm produce to consumers and contractors, establishment of special and private markets, infrastructure development, single levy of market fee and freedom to market functionaries to operate in different markets through registration. Provisions of the Act have been adopted but these vary across states. While some states have adopted the Act in its full measure, many have adopted it partially (Economic survey 2014; Chand and Singh 2016).

Karnataka is the leading state in implementing the Model Act, 2003. The state introduced e-tendering system, an innovative approach for price discovery, adopting the modern information communication technology to encourage fair marketing practices and to ensure competitive prices to farmers for their produce. The e-tendering paved way for integration of agricultural markets in the state through an online platform. The Government of Karnataka in collaboration with the National Commodity Derivative

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Exchange (NCDEX) implemented the concept of Unified Market Platform (UMP) in 2014, and a separate institution named Rashtriya e-Market Service Private Limited (ReMS) was created for providing e-marketing services. It provides access to all the traders having a unified market licence for participation in online trading of agricultural commodities in APMC markets across the state. Following its success in Karnataka, the model was adopted in other states namely Gujarat, Maharashtra, Andhra Pradesh and Telangana. Subsequently, the Cabinet Committee of the Government of India approved a central sector scheme for promoting the concept of National Agricultural Market or NAM (Chand 2016).

In its budget of 2016-17, the Government of India announced the implementation of e-National Agricultural Market (e-NAM) to provide a common trading platform across the selected 585 regulated markets in the country. e-NAM is expected to reduce information asymmetry between buyers and sellers, promote real-time price discovery, transparency in the auction process, access to a nationwide market to farmers, attain pricing that is commensurate with quality of produce and introduce online payment system (GoI 2016). The initiative has been widely acclaimed and is considered as 'a game changer' (Chand 2016). In the first stage of e-NAM, 250 regulated markets across 10 states have been integrated.

In this paper, we examine the effectiveness of e-tendering system for pigeon pea in Karnataka and explore stakeholders' perceptions regarding online trading to better understand the challenges in implementation of this innovative agricultural marketing initiative. Rest of the paper is organized as follows: Section 2 provides background on e-tendering process in Karnataka. Data and methodology are discussed in the third section, fourth section presents the results, and is followed by the section discussing the salient findings and lessons learnt. Conclusions and policy implications are presented in the last section.

2 Background

E-tendering was initiated by the Government of Karnataka in association with the NCDEX (the largest agricultural commodity exchange) under the Mandi¹ Modernisation Programme (MMP) in May 2009. The

MMP programme aimed at enhancing marketing efficiency by removing supply chain bottlenecks, and ultimately to unify the regulated markets across the state through an online platform for buyers and traders. Initially, the state government collaborated with the National Information Centre (NIC) for developing software for e-tendering. The system was implemented through Karnataka State Electronics Development Corporation Limited (KEIONICS) and later the platform was transferred to NCDEX.

The aim of the MMP was to transform the state into 'one-state one-market' providing a level playing field to buyers across the scattered markets. E-tendering was the first step towards realizing the objective of market unification through automation of commodity auction. The success of the pilot on e-tendering for paddy in Mysore district in 2006-07 encouraged its replication, to all the 155 major agricultural markets in the state (Chengappa et al. 2012; Shalendra 2013). Commodity coverage now includes cotton, chilly, copra, areca-nut, turmeric and even perishable commodities e.g., mango.

Gulbarga was one of the first districts in Karnataka where e-tendering system was introduced for pigeon pea in 2011. Despite the initial resistance by traders, with persistent efforts of the officials through personal visits to farmers and traders and trainings of traders, the e-tendering process could be successfully implemented. However, subsequent geographical expansion of e-tendering model in the neighbouring Sedam and Chittapur talukas of Gulbarga district was hindered due to opposition by the local traders and commission agents. At present, these three APMC markets are practicing different methods of price discovery. Gulbarga market has successfully adopted e-tendering method, while Chittapur and Sedam markets, though equipped with the infrastructure, follow open auction and direct method, respectively. Also, despite successful implementation of e-tendering process in Gulbarga APMC it has not yet been integrated with other major markets of the state.

A schematic representation of e-tendering process is shown in figure 1. In this system, every lot of commodity that arrives in the market has to pass through a lot-entry procedure at the main gate and is provided with a computer generated unique

¹Mandi is a Hindi word meaning market.

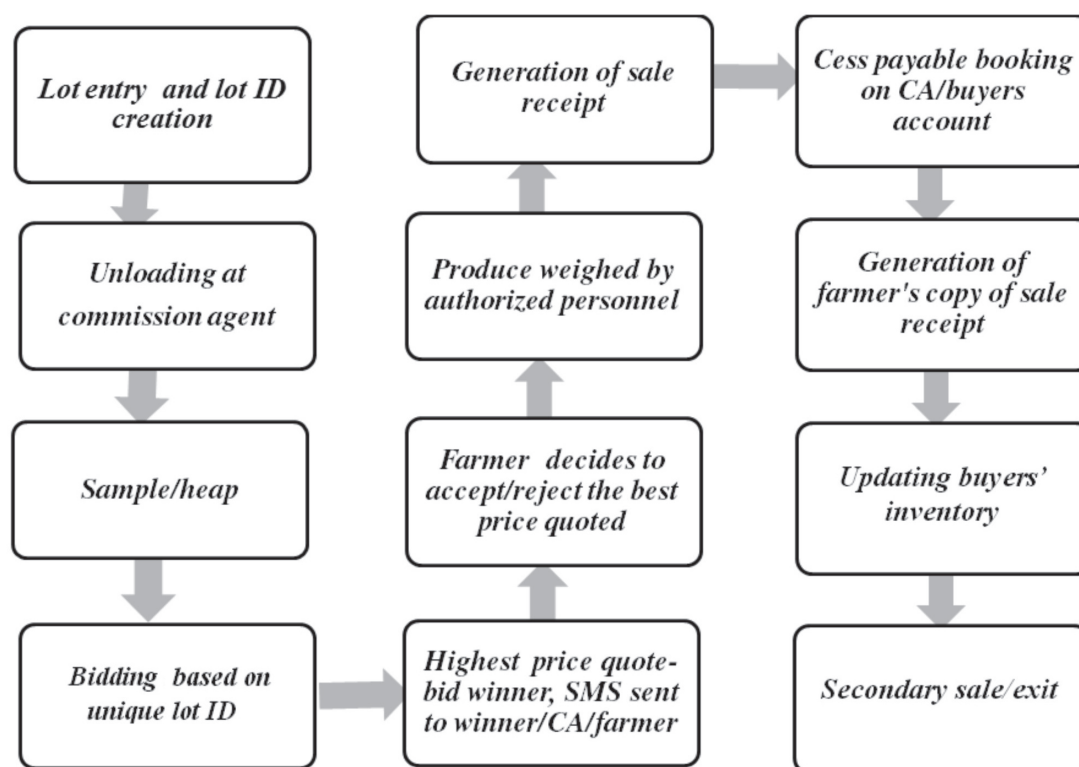


Figure 1. Mechanism of e-tendering

Source: Information from APMC officers

identification number (e-gate entry)². Then, samples of about 300-500 grams are collected from different lots and are displayed for examination by the traders or commission agents to decide on the price quote³. In the next stage, the traders login to their respective registered accounts and quote prices for the selected lots. The trader with the highest price bid wins, and the final bids are displayed on electronic display board. The details of final price along with lot ID and name of the trader or commission agent are sent to all the registered traders and farmers through SMS.

The system of e-tendering has advantage over other methods (open auction, manual tender and direct sale) because of transparency in price discovery. Open auction system does provide some scope for mutual negotiation among traders in the process of price discovery. Manual tendering system could also allow for market malpractices such as alteration of quotes,

and errors in their entry and compilation. In the case of direct sale, farmer is a price taker because of the absence of other competitive mechanisms of price discovery. The time taken to declare bids is much lower in e- tendering system. Thus, e-auctioning offers advantages of transparency, competitive price discovery, and reduced transaction time⁴. E-tendering also improves market income due to mandatory e-gate entry.

3 Data and methodology

The study was conducted in three APMCs from Gulbarga district viz., Gulbarga, Chittapur and Sedam talukas.⁵ The analysis is based on surveys of traders and market officials and farmers. Several rounds of focussed group discussions were held with market officials, farmers and traders to obtain qualitative information on pigeon pea marketing. Information on

² Under e-gate entry arrival of every lot is authenticated by computer generated lot ID.

³ During the interactions with farmers, it was found that this method has also helped in checking the practice of taking higher sample of 1-2 kgs of pigeon pea for physical examination by traders.

⁴ Throughout the paper e-tendering and e-auctioning are used synonymously.

⁵ A taluka is a sub-unit of a district.

market revenue, prices and arrivals was obtained from the APMC records. E-tendering in Gulbarga was first introduced for pigeon pea. Note that Gulbarga market accounts for more than 55% of total pigeon pea arrivals in the state. Hence, pigeon pea was selected as a specific commodity for this study. Following a pilot survey in the selected markets and villages, surveys of farmers and traders was conducted in 2015-16. A total of six villages, two in jurisdiction of each market, were selected, and from each village a sample of 30 farmers was drawn randomly. A total of 63 traders and 14 market officials from these markets were also interviewed to know their perceptions on the impact of e-tendering. Farmers and traders were asked to order the positive attributes of e-tendering process. The order of merit of a rank was converted to percent position using Garrett rank conversion table:

$$\% \text{ position} = 100 (R_{ij} - 0.5) / N_j$$

where, R_{ij} is j^{th} rank of i^{th} attribute. N_j is the maximum rank in the order. Finally, the attributes were ranked based on Garrett score.

A logit model was employed to identify factors influencing participation of traders/commission agents in e-tendering system. The model predicts the probability of a binary outcome using maximum likelihood estimation method. The logistic function is:

$$E = (Y_i / X_i) = \Pr(Y_i / 1 - X_i) = \frac{1}{1 + \exp - (\beta_0 + \beta_1 X_i)} \dots (1)$$

where, E is log odds ratio or log odds in favour of dependent variable Y_i estimated using the following logit model. The estimated logit model is:

$$Y = \ln(P_i / 1 - P_i) = \beta_1 + \beta_2 X_{\text{lic}} + \beta_2 X_{\text{qty_tr}} + \beta_3 X_{\text{comp}} + \beta_4 X_{\text{mkt_atti}} + \beta_5 X_{\text{ump_perc}} + U_i \dots (2)$$

where, Y_i is the dependent variable that takes value 1 if a trader or commission agent participated in e-tendering, and zero otherwise. Explanatory variable X_{lic} indicates the type of license held by the trader or commission agent i.e., either trader-cum commission agent or only trader or only commission agent and $X_{\text{qty_tr}}$ is the quantity of pigeon pea traded. Variables X_{comp} , $X_{\text{mkt_atti}}$ and $X_{\text{ump_perc}}$ are binary in nature indicating status computer knowledge of the respondent, willingness to participate in e-tendering and perception on UMP respectively. They take the value of 1 if indicated in yes or positive perception by the respondents, else zero.

Table 1. Profile of pigeon pea farmers, 2015-16

Variables	Gulbarga	Chittapur	Sedam
Age (years)	41.64	40.63	39.98
Distance from the market (km.)	22.54	10.35	6.00
Family size (No.)			
Male	3.00	4.00	3.00
Female	3.00	4.00	3.00
Total	7.00	7.00	6.00
Schooling (years)	7.17	9.00	7.98
Computer knowledge (%)	7.00	13.33	10.17
Land holding size (acres)	11.91	12.71	10.36

Source: Field survey.

The model was tested for specification error and was found to be free from any specification bias.

Table 1 presents the key characteristics of sample farmers. The average land size ranges from 10.36 acres to 12.71 acres. Also, there is hardly any significant difference in the age, education level and knowledge of computers among the farmers of the selected markets. In fact, only a small proportion of farmers have any understanding about the operation of computers.

Table 2 presents key characteristics of the traders. Compared to the traders in other markets, traders in the Gulbarga market are better in schooling and computer knowledge. Gulbarga and Chittapur markets are dominated by traders with dual-license- a majority having license of trader-cum-commission agent or export import-cum commission agent.

Compared to other markets, Gulbarga APMC is a larger market, in terms of geographical coverage as well as number of traders. It is also equipped with adequate infrastructure and staff (table 3). All the three markets have requisite infrastructure for implementing e-tendering system (electronic display unit, computers, e-tendering units and generator facilities). Gulbarga and Sedam APMCs have a separate e-tendering cell, with partition cabins for ensuring discretion during e-tendering. However, none of the markets have fire extinguishing system.

Gulbarga is an important market for wholesale trade in pigeon pea. It accounts for about 56% of the total pigeon pea arrivals in the state. The other two markets

Table 2. Profile of traders, 2015-16

Variable	Gulbarga	Chittapur	Sedam
Age (years)	36.38	44.13	38.36
Schooling (years)	13.50	13.33	13.93
Computer knowledge (% yes)	91.18	50.00	71.43
Experience in trading (years)	8.74	18.87	11.79
Quantity traded (quintals/trader)	2622	3430	2764
Type of licence (% respondents)			
Commission agent	23.53	26.67	64.29
Trader-cum-commission agent and Export/Import-cum-commission agent	76.47	73.33	35.71

Source: Field survey.

Table 3. Status of infrastructure and staff strength, 2015-16

Facility	Gulbarga	Chittapur	Sedam
Size of market yard (acres)	62.2	21.1	56
Staff			
Sanctioned	48	15	13
In position	25	3	6
Electronic display unit (No.)	1	2	1
Electronic weighing machine	Yes	Yes	Yes
Desktop	15	9	8
Laptop	Nil	Nil	3
Partition cabin in e- tendering cell	Yes (15)	No	Yes
E-tendering units	2	1	1
Generator	Yes	Yes	Yes
Fire extinguisher	No	No	No
Licensed commission agents	582	238	220
No. of active commission agents	301	66	110
No. of licensed traders	1298	238	30
No. of active traders	386	147	7
No. of weigh-man	144	7	2
No. of Hamals	589	96	181
No. of stockists	1295	60	162
No. of importers	1298	224	-
No of exporters	1298	224	-

Source: Compiled from APMC markets.

viz., Sedam and Chittapur together share 7% of the total arrivals. Figure 2 shows trend in volume of pigeon pea traded. During 2013-2015, on average 1,507 thousand quintals of pigeon pea valued at Rs 83,263 crores was traded in Gulbarga market. The arrival of pigeon pea in this market remained on a rising trend until 2010-11, but fell afterwards (figure 3).

Interestingly, year-on-year fluctuation in arrivals is more in Chittapur and Sedam markets than in Gulbarga market.

The modal price⁶ of pigeon pea, in general, has been higher in Gulbarga market. In 2013-15, it was 6,288 Rs/qtl, 12 to 14% higher over those prevailing in

⁶ Initially modal price was calculated as the average of maximum and minimum prices. Following computerisation of the APMCs it is estimated as the most frequent price quoted for a commodity.

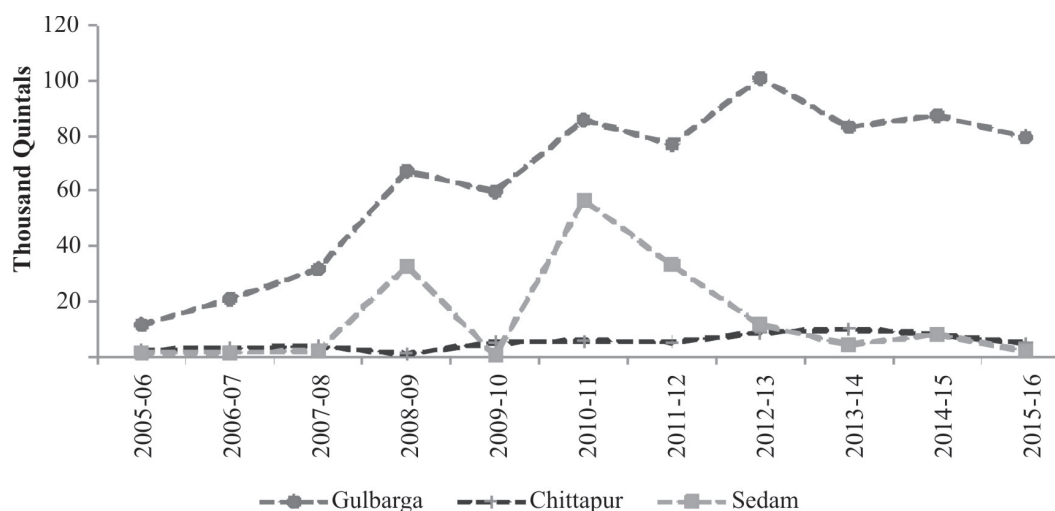


Figure 2. Trend in arrivals of pigeon pea

Source: APMCs.

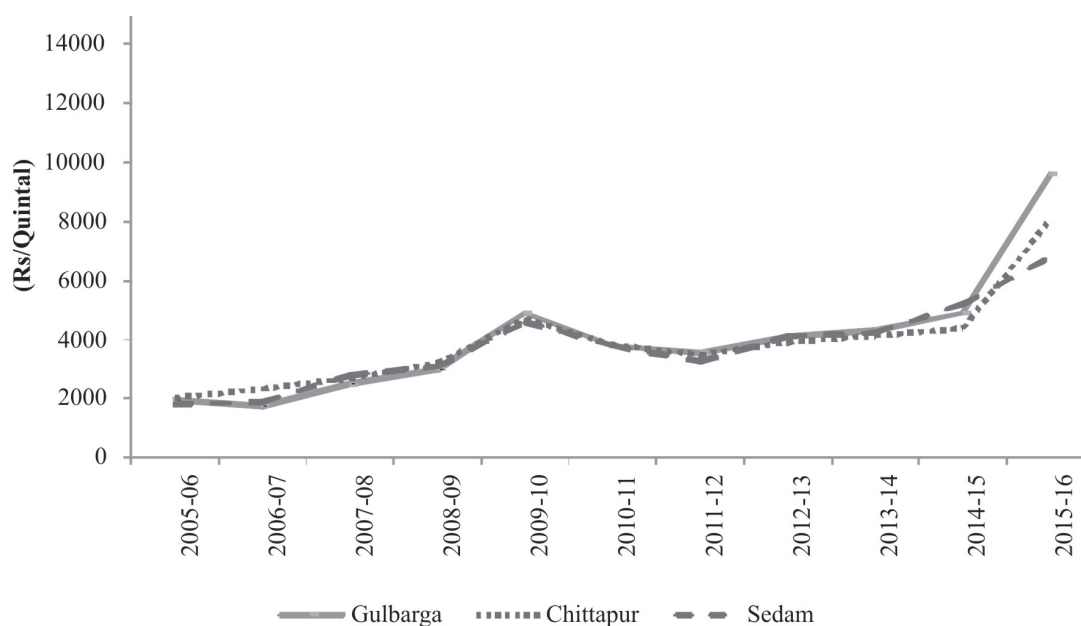


Figure 3. Trend in price of pigeon pea

Source: APMCs

Chittapur and Sedam markets (figure 4). The higher price in Gulbarga in recent years can be attributed to e-tendering that led to transparency in the price discovery. This is in line with an earlier observation of Banker and Mitra (2005) that shows the coffee traded through electronic tendering fetched 4% higher price over the price determined through physical auction. The key takeaway is that e-tendering brings transparency in price discovery enabling farmers to realize higher prices.

4 Impact of e-tendering system

4.1 Impact on traders

The computerised system of tendering reduces time required to finalise the highest price bid and announcement of the winner (table 4). The average time taken for pigeon pea sale is the lowest for direct trading mode. Over open auction system of price discovery, e-tendering takes 40% less time, hence it reduces transaction costs in terms of labour saved and other

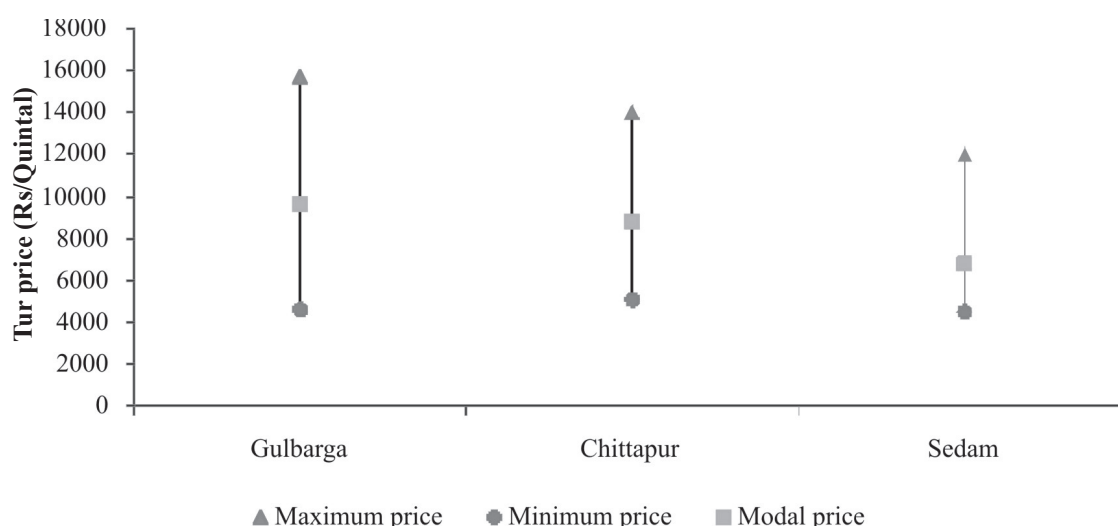


Figure 4. Maximum, minimum and average modal prices of pigeon pea (Rs/Quintal) in TE 2013-15

Source: APMCs.

Table 4. Market transaction time under various methods of marketing (hours)

Method of sale	Normal arrival period	Peak arrival period
Open auction	4.03	5.77
Manual tender	4.51	5.89
E-tender	2.66	3.66
Direct trading	0.56	0.82

Source: Field survey.

associated expenses. Mueller (2000) has arrived at a similar conclusion that e-auction platforms reduce transaction costs by lowering trade cost, or transfer costs or both. It may be noted that besides saving in transaction time, e-tendering avoids chances of human errors in compiling price bids, helps overcome malpractices of open auction and manual tender systems.

The perceptions of traders from Gulbarga market on the effectiveness of e-tendering system are provided in table 5. A majority of them agree that they have been adequately trained in e-tendering process. More than two-thirds of them feel that market has necessary infrastructure for e-tendering. A large number of traders (70%) use online system on their own, and the

remaining rely on their hired assistants. Close to two-thirds of them have reported no technical issues in online tendering system. There is an unanimous opinion among traders that online tendering system has reduced transaction time, saving on an average 2.5 hours per transaction, and minimized the scope for manipulation of prices. Interestingly, a majority of the traders have reported that e-tendering has not affected their traditional links with the farmers.

Traders in Chittapur and Sedam markets also shared their perceptions on e-tendering, and the reasons for not adopting the same (table 6). In general, there is a lack of awareness on the operation of e-tendering, more so among the traders in Sedam market. Further, there are apprehensions that e-tendering being a transparent process enhances market competition and leaves little scope for price manipulation that could adversely affect their profits. Further, with markets being integrated there is a very high probability that price discovery will be influenced by the prices in Gulbarga market that are higher than the prices in these markets. It is also perceived that e-tendering would adversely affect their business relations with farmers that often transcend beyond commodity transaction. Traders often advance credit (cash or kind) to farmers against their commitment of sale of output⁷.

⁷ In our survey we found that 83% farmers in Chittapur, 48% in Sedam and 44% in Gulbarga relied on credit from the traders and commission agents, and hence, were obliged to sell their produce to them.

Table 5. Traders' perceptions on e- tendering in Gulbarga market

Attribute	% agreed
Adequate training on e-tendering is provided	94.12
Satisfied with the training	91.18
Market has sufficient infrastructure for e-tendering	67.65
Proportion of traders quoting the bids on their own	70.59
No technical constraints in using e- tendering	64.71
The software is user-friendly	91.18
Sufficient time available for bidding process	58.82
Reduction in transaction time	100.00
Average time saved (hours)	2.29
Scope for price manipulation	5.88
E- tendering has increased revenue due to competitive prices	67.65
E-tendering alters traditional link between farmers and traders	14.71

Source: Field survey.

Table 6. Perceptions of traders in Chittapur and Sedam markets on e-tendering system (% Agree)

Attribute	Chittapur	Sedam
Adequate training on e-tendering provided	13.33	50.00
Market has sufficient infrastructure for e-tendering	20.00	42.86
Awareness about e-tendering	40.00	100.00
Farmers use Gulbarga market prices as reference price	26.67	92.86
Price quote is influenced by the prices in Gulbarga market		100.00
100.00		
E- tendering increases market competition	66.67	100.00
There is scope for price manipulation in the existing system	6.67	21.43
Given adequate training and infrastructure whether you would participate in the e-tendering process	46.67	21.43
E-tendering alters traditional link between farmers and traders	53.33	28.57
Reasons for not adopting e-tendering		
No response/not aware	20.00	28.57
Need more training	26.67	-
Lack of computer knowledge	20.00	7.14
Inadequate market staff for technical support	13.33	7.14
Not interested	20.00	57.14

Source: Field survey.

Traders indicated several reasons for their non-participation in e-tendering process. These include lack of computer knowledge, inadequate market infrastructure and lack of technical support. This makes us to infer that markets with smaller volume of business are not competitive and traders are unwilling to forgo the rent they earn through manipulation of prices, under-weighting of produce and tied transactions.

To identify factors influencing the traders' participation in e-tendering process, the logit model has been used. The predictor variables include: type of license held by the trader (single or dual), volume of trade, knowledge of computers, perception of traders about the effects of market integration, and their willingness to participate in e-tendering. To capture the effect of market size and other market-related attributes, we

Table 7. Logit estimates for the determinants of traders' participation in e-tendering system

Variables	Unit	Coefficients	Odds ratios	Marginal effects
Type of license	Dual =1, otherwise=0	2.78*** (0.98)	16.07	0.2718
Market	Gulbarga=1, Others=0	2.02* (1.04)	7.53	0.1976
Traders' perception on UMP	Positive perception=1, Negative=0	2.80** (1.15)	16.51	0.2744
Market attitude	Willingness to participate in e- tendering=1, Otherwise=0	3.17*** (1.10)	23.94	0.3108
Quantity of pigeon pea traded	Quintals/trader	.001** (0.00)	1.00	0.0001
Computer knowledge	Yes=1, No=0	2.46** (1.14)	11.67	0.2405
Constant		-8.73	.002	-0.8548
Prob> chi2	0.0000	Log likelihood	-19.57	

Figures in parentheses are standard errors. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

include dummies for markets. The model was tested for specification bias, and the test-statistics indicates no specification bias.

The regression estimates are presented in table 7. As expected, the probability of participation of traders in e-tendering is higher in Gulbarga market than in other markets. In other words, the implementation of e-tendering is likely to be more successful in larger markets. Further, the traders who hold dual license are more likely to participate in e-tendering process because of their greater requirement of pigeon pea for domestic as well as international market. This is also substantiated by the volume of business of individual traders. The volume of business has a direct bearing on their participation in e-tendering. More importantly, it is the attitude towards e-tendering and market integration that influence their participation in the system. The odds of participating in e-tendering is higher in case of traders with willingness to participate in e-tendering and for those with a positive perception on the effects integration of APMC markets. In other words, smaller traders fear losing their business or profit due to competition caused by the transparent process of price discovery in e-tendering process. Additionally, the capacity of traders to understand and implement the computerised process appears to be an important issue. Those who do not have knowledge of computers and software need to hire trained staff, the wages of which could offset the potential gains from participation in e-tendering.

4.2 Impact on farmers

Farmers, traders and commission agents of Gulbarga were asked to rank the important attributes of e-tendering system. From farmers' perspective, increased competition in markets is the most important feature of e-tendering, followed by transparency in price discovery (table 8). This is expected as both these attributes ensure higher price to them. Traders consider reduction in transaction time, increased competition and transparency in pricing as important attributes of the system in the order of ranking. They also feel ease in e-auctioning and electronic transfer of price information as other useful attributes of the system.

In table 9 we present responses of the farmers on other important aspects related to the operation of e-tendering system. Farmers in the jurisdiction of Gulbarga market indicate that e-gate entry of the produce is mandatory, and a majority of them find that with e-tendering competition in the market has increased. Only 2% of them are apprehensive that there could be some scope for price manipulation under e-auctioning also. As expected, 71% of them reported decline in the time taken in disposal of the produce. And, almost everyone has reported to receive payment receipt from the commission agents or traders immediately and on the same day. Three-fourths of the farmers also feel that electronic transfer of sale proceeds is better than cash payment.

Table 8. Ranking of most important attributes of e- tendering system by farmers and traders

Favourable attribute	Farmers' ranking		Traders' ranking	
	Garrett score	Rank	Garrett score	Rank
More competition	63.81	1	58.53	2
Transparency in pricing	52.97	2	50.00	3
Time saving	43.05	3	61.32	1
Better price realization	39.49	4	-	-
Easy process	22.03	5	35.74	4
Quick dissemination of price	-	-	32.94	5

Source: Field survey.

Table 9. Perceptions and responses of farmers in market on e-tendering

Feature	Gulbarga (%)
Whether e-gate entry is mandatory?	100.00
E-tendering system has increased market competition?	89.83
E-auctioning system has reduced the time taken for produce disposal	71.19
Do you receive a payment receipt?	98.31
Is payment done on the same day?	66.10
Have you ever rejected a lower price bid?	79.66
Do you feel traders can manipulate the price?	2.00
Whether the system is able to handle the peak season arrivals?	71.19
Whether farm level grading of pigeon pea is done before marketing?	40.68
Grading at farm level is expensive	66.10
Grading should be introduced in the market?	71.19
Do you have timely access to market information?	77.97
Direct transfer of amount to farmers' account is better than cash payment	76.27

Source: Field survey.

Quality matters in price determination, but about 60% of the farmers do not grade their produce at farm level, assuming that it is expensive, and they suggest introduction of mechanical grading facilities in the market yard.

4.3 Impact on market revenue

The implementation of e-tendering in Gulbarga market has led to significant increase in market arrivals and revenue, but it has also experienced an increase in expenditure. According to market officials, it happened due to mandatory implementation of e-gate entry of produce. The savings also increased significantly, touching a high of Rs 1,199 lakhs in 2014-15 (table 10).

Table 10. Trends in income, savings and expenditure of Gulbarga market (Rs lakhs)

Year	Revenue	Expenditure	Savings
2005-06	396.72	251.75	144.97
2006-07	749.56	445.34	304.23
2007-08	876.52	495.65	380.87
2008-09	910.09	476.56	433.52
2009-10	912.07	610.07	302.01
2010-11	1092.98	316.60	776.39
2011-12	1228.40	1186.69	41.70
2012-13	1300.36	1000.02	334.52
2013-14	1472.96	911.99	560.96
2014-15	1400.78	201.83	1198.95
2015-16	1424.25	913.16	511.09

Source: APMC.

Note: Revenue, expenditure and savings are at current prices.

We also sought opinion of the officials of these markets to understand their views on e-tendering. Their response clearly indicates that e-tendering reduces transaction time, eases process of auctioning and helps better upkeep of market records. Most of them also feel the need for improvements in the back-up infrastructure, i.e., storage and warehousing facilities in the market yard, and building up of the capacity of market staff for effective implementation of the system.

5 Conclusions and implications

The findings of this study have clearly brought out that e-tendering system has considerable potential to infuse competition and transparency in agricultural markets, and to reduce costs of trade for both buyers and sellers without adversely affecting their trade relations and revenue. This is a crucial feedback for policymakers to strengthen the government's initiative of e-NAM that aims at creating a national market for agricultural commodities. The study has also come out with some constraints that need to be addressed.

The governments provide financial support for creating essential infrastructure (computers, software, uninterrupted power supply and internet) for implementation of the concept of one-nation one-market. This alone, however, is not sufficient. Effective implementation of e-NAM also requires infrastructure in the form of storage, warehousing, banks, grading and assaying facilities, etc. within the market yard, the absence of which may discourage traders from far off places to participate in e-tendering.

Further, it has been observed that despite decent infrastructure being available for e-tendering, the open auction and direct trading also prevail alongside for a number of agricultural commodities other than those specified for e-tendering. It is, thus, important to bring all the commodities under the purview of e-tendering as indicated by Aggarwal (2016).

The other issue relates to whether all markets, irrespective of the volume of trade, be brought under the gambit of e-NAM or the process should be scale discriminatory leaving the smaller markets outside the e-NAM. Our findings indicate that e-tendering is successful in larger markets, and not in smaller ones. This is because of several issues related to capacity of the market committee, and apprehension among traders that with automation they would lose their business to

large traders. Whether e-auctioning and e-trade could be successful in small markets with very low arrivals and few buyers needs further exploration. Yet, the immediate need is to build up capacity of the market committees and traders in e-tendering and e-auctioning and alleviate the apprehension regarding the negative impact of e-tendering.

There is also an apprehension among traders that e-trading may affect their traditional links with commission agents and farmers. There is a high incidence of tied transactions where traders advance credit to farmers on the latter's commitment of sale of produce. It is feared that direct transfer of sale proceeds to farmers' account might affect recovery of credit. Findings indicate these apprehensions do not hold any ground. Nonetheless, the need is to improve farmers' access to institutional credit to reduce their dependence on traders and commission agents.

Farmers benefit from e-trading, and there is a need to create awareness among farmers of the benefits of e-trading and build their capacity in online banking and grading of produce at farm level. Also, there is a need to organize farmers into collectives to enable them to capture benefits of scale in marketing Self-Help Groups (SHGs) and Farmer Producer Organizations (FPOs) are the options for this. Farmers feel that farm-level grading of produce is expensive while market officials feel that the practice of grading in the market yard would be time consuming. Our study reflects that traders have a strong preference for physical examination of produce to ensure product quality. This has a bearing on the concept of national market integration wherein the product is traded based on online grade specifications. Hence, establishment of adequate assaying facilities for grading and quality is important.

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