

# Electronic national agricultural markets: the way forward

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*The Model Agricultural Produce Marketing Act (APMC Act), 2003, and recent improvements to it through Model Agricultural Produce and Livestock Marketing (Promotion and Facilitating) Act (APLM), 2017, provide some hope in increasing efficiency in agricultural markets in India. The Model APLM Act advocates increased competition in the marketplace by allowing private markets, farmers' markets, and electronic-National Agricultural Markets (eNAM). Under eNAM, the Central Government introduced electronic trading in about 400 APMC markets in 2016 and connected them through uniform market platform in line with the e-markets of Karnataka introduced in 2012. This article examines experience of e-markets in Karnataka since 2012, with the intention to suggest improvements to eNAM. Results show that e-markets help increase competition, eliminate collusion among traders resulting in increased farmers' price and market arrivals. They facilitate competitive bidding and same day payments to farmers. However, there was some resistance from traders and commission agents as they felt that there were no benefits in e-auction compared to physical transactions. In addition, there was fear of taxation of on-line transactions. Aligning interests of all stakeholders, including farmers, traders and commission agents is the biggest hurdle in the implementation of eNAM.*

**Keywords:** Agricultural commodities, commission agents, electronic markets, farmers, traders.

AGRICULTURAL markets are real or virtual meeting places where buyers, sellers and intermediaries meet to exchange commodities between seller and buyer. In the exchange process, sellers, buyers and intermediaries face many counter-party risks, like delivery failures, substandard quality and delay in payments. There is potential for opportunism given the divergent interests of different market participants<sup>1</sup>. To protect the illiterate farmers from exploitation by traders and commission agents, state governments started enacting Agricultural Produce Marketing Committee (APMC) acts since 50s. This is done to ensure fair price to farmers, reliable market information flow, enforce rules and to build trust among different stakeholders to reduce the uncertainties and risks inherent in the market process<sup>2</sup>. These regulated markets functioned from block headquarters and only a few registered traders and commission agents were allowed to trade in them. Given that only a few traders and commission agents were buyers and there were many farmers to sell their produce, there was a possibility of cartels among traders and commission agents to rig bids at lower prices to farmers. Due to the APMRA, regulated markets

behaved like monopsony markets (single buyer for agricultural produce from the farmers) and hindered development of alternative competitive agricultural marketplaces like private markets, direct farmer-to-consumer markets and contract farming in local areas<sup>3,4</sup>. This resulted in inefficient markets with cartelization of traders and commission agents to put downward pressure on farmer's sale price during harvest season.

## Agricultural market reforms

After realizing the ill-effects of monopsony by regulated markets during 1990s, the Union government formulated the Model Agricultural Produce Marketing Committee (APMC) Act, 2003, with an advice to the states to implement some reforms like the removal of licensing requirements, stock limits and movement restrictions; and inclusion of provision of private markets, direct marketing and contract farming in the model APMC Act. However, implementation of model APMC Act 2003, was rather 'patchy' and 'uneven' across the states. In continuation of market reforms, more recently, the Model Agricultural Produce and Livestock Marketing (Promotion and Facilitating) Act (APLM), 2017, advocated electronic-markets (e-markets) through abolition of concept of notified area, so that anyone from anywhere can trade in

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a local market through participation in electronic auction platforms. E-markets are 'virtual' markets with physical market at the back end. Separation of electronic trading from physical movement of produce is also promoted through popularization of warehouse receipts by declaring warehouses as sub-market yards of e-markets. This will reduce logistic costs through economizing unnecessary movement of goods. The necessary conditions for e-markets are: (i) single-point levy of fee across states; (ii) unified single trading license, (iii) bidding process through electronic auctions. Some other provisions in the Act like inter-state trade license, uniformity in taxes, delisting fruits and vegetables from APMC markets, encouragement of private markets, entire state to be treated as one market for promotion of contract farming, creation of nationally important market yards and standards to promote e-markets are also helpful in making agricultural markets competitive. Some states have fully implemented these reforms, but most of them have only partially implemented the same.

### Electronic national agricultural market

In 2016, the Government of India introduced the e-National Agricultural Market (e-NAM) portal integrate 585 APMC physical markets and create a unified national market by attracting buyers from all over the country through electronic auction. This eliminates the multiple physical handlings at various levels and with multiple market fees. It is a huge effort with many agencies involved like the central government providing uniform policy framework, Small Farmers Agribusiness Consortium (SFAC) playing the role of lead agency along with strategic private partner Nagarjuna Fertilizers and Chemicals Limited for maintenance of the portal, Directorate of Marketing and Inspection (DMI) for providing technical support for harmonization of standards for commodities and assaying facilities, National Information Centre (NIC) for providing necessary servers to host e-NAM portal, state governments and marketing boards providing storage and warehousing facilities, regulate and dispute resolution mechanism to APMC markets, and APMC markets for implementation of physical and online trading.

#### *Process flow of e-market*

Figure 1 presents process flow of e-market. In e-markets, all related activities starting from gate-entry receipt to farmer (registration of farmer's name, commodity name, bank account number, lot number and quantity) to allocation of commission agent, bidding by each trader, selection of highest price bidder and announcement of final bid winner with sale price are done online. Traders can bid from 9.30 am to 1.30 pm, and final bidders will be announced by 1.30 pm. After e-auction, the system notifies

the highest bidder for each lot. Notified information will be disseminated through announcement, scrolling on TV screen in the market and by SMS to farmers, traders and commission agents regarding the price, name of the farmer, trader and commission agent<sup>5,6</sup>. If a farmer accepts the price, sale bill will be generated, and money transfer and delivery will take place by 2.30 pm. Money transfer is done from trader's account to exchange account and in turn will be transferred to farmer's account after deduction of commission and other charges. E-permit will be generated online by 2.30 p.m. on the same day.

### Multiple stakeholders and theory of change

The success of e-market platform depends on meeting the expectations of all market participants (farmers, traders, commission agents and market committee members) simultaneously. If one group is not satisfied, the market will not function effectively. A successful e-market should incentivize farmers through higher prices and timely payments, incentivize traders through reduced transaction costs and providing logistics, and satisfy the commission agents through higher market arrivals and turnover to make their business viable. E-market should provide reliable assaying facilities to help distant traders participate in the biddings. It should be more convenient to market officials to serve the requirements of farmers, traders and commission agents. Overall, e-market success depends on attracting more market arrivals coupled with fair prices for the farmer's produce in a short time-frame with lower transaction and learning costs. Only then can farmers, traders and other participants invest in the skills, software and hardware necessary to participate in the e-auction. Figure 2 illustrates the theory of change behind the e-market.

### Choice of markets

Farmers choose where to sell their produce based on comparative marginal costs and returns. Traditionally, farmers find it more convenient to sell their produce to the village traders or APMC markets on open auction rather than e-markets. However, choosing the most convenient market may provide less price compared to competitive e-markets. Optimal market choice involves weighing returns to market use against market costs and opportunity costs of not using alternative markets. Higher participation of sellers and buyers is essential for the success of any market. Volume begets volume, lack of volume begets lack of volume. If the sellers are not able to get remunerative prices, they may shift to other marketplaces; loss of sellers implies less options for the buyers. This may lead to buyers quitting the marketplace resulting in a downward spiral in market arrivals. Electronic markets improve the market structure, which

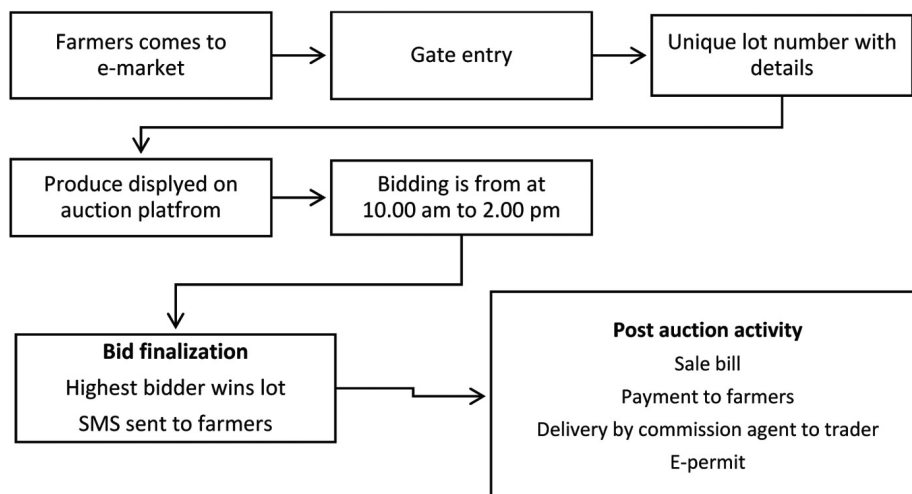


Figure 1. Process flow chart of e-market.

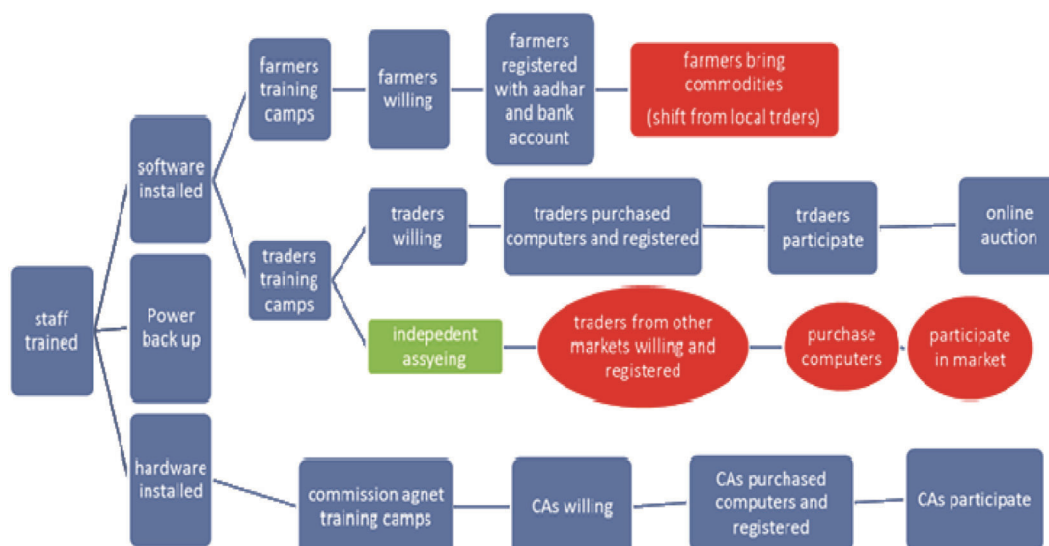


Figure 2. Multiple stakeholders and theory of change.

enhances the prices to the farmers. The adoption of e-markets also depends on the skill and knowledge level of the traders, commission agents and farmers.

As on 31 March 2017, eNAM has been integrated in 13 states which includes 417 APMC markets. About 39 lakh farmers of an estimated 13 crore farmers in the country and 88,000 traders and 43,000 commission agents have also registered. Rs 15,000 crores with commodities were traded on the e-NAM portal. India's total trade in agricultural commodities is worth more than Rs 6 lakh crores annually.

With wider penetration of IT infrastructure, both through computers and mobile network, there is a possibility of quick scaling-up of successful e-market models across all states. The design of e-market plays an important role in increasing penetration. While designing,

the needs of various stakeholders and complex socio-economic set up of rural agricultural markets have to be considered. There is lack of systematic analysis of the existing e-markets in this perspective.

Initial experience of eNAM shows that the market arrivals are not picking up. Also, there was some resistance from traders and commission agents in the implementation<sup>4</sup>. Given the Karnataka experience with e-markets since 2006, this article aims to suggest improvements in the implementation of the e-NAM platform.

The specific objectives of the study are: (i) To assess the functioning of e-markets in Karnataka from the stakeholders' perspectives and also process innovation perspective. (ii) To assess the impact of e-market on prices received by farmers and market arrivals. (iii) To provide lessons learned from e-markets in Karnataka to eNAM.

### Data and methodology

The utility of any e-market depends on its design and implementation. Ribbers *et al.*<sup>7</sup> introduced a new methodology to classify various complex economic issues that arise while designing and implementing electronic markets. In this framework seven elements were explained in detail to describe e-markets, viz. (1) farmers, (2) traders, (3) commodities, (4) market organization, (5) market quality, (6) e-market success and (7) competition with other market spaces.

We have also used a process-stakeholder analysis framework to assess e-market designs. We adopted the Kambil and van Heck model<sup>2</sup> which includes five trade processes (search, valuation, logistics, payments and settlements and authentication) and five trade context processes (communications, product representation, legitimation, influence and dispute resolution). We have selected three commodities for the impact study, viz. paddy, copra and groundnut, as these are being traded on e-markets since 2012. For each commodity, 30 e-markets (with 15 e-markets as treatment and another 15 as control) were selected for collecting daily prices and arrivals data from 2007 to 2016 (from [www.agmarknet.org/](http://www.agmarknet.org/)) to know the impact of e-markets. We have used difference-in-difference (DID) approach to assess the impact of e-markets on price received by farmers and market arrivals. DID is a quasi-experimental design widely used to assess the impact of any government programme by comparing treatment (e-market) with control (non-e-market) using time-series data to estimate a causal effect of the treatment. The approach is used to estimate the effect of a specific government programme by comparing the changes in outcomes over time between the treatment group and control group.

The following DID formula was used to assess the impact of e-market:

$$Y = \beta_0 + \beta_1 \times \text{time} + \beta_2 \times (\text{e-market dummy}) + \beta_3 \times (\text{time} \times \text{e-market dummy}),$$

where  $\beta_0$  is the constant term and indicates the baseline average of prices before e-market,  $\beta_1$  indicates price trend in the control group (non-e-market),  $\beta_2$  indicates the difference between the two groups for prices before introduction of e-market,  $\beta_3$  indicates the impact of e-market on change in prices in e-market over non-e-market.

We are basically interested in the impact coefficient  $\beta_3$ . To overcome the heteroscedasticity problem, robust standard errors are taken in the model. In the absence of treatment (without e-market scheme), the unobserved differences between e-market (treatment) and non-e-market (control group) are the same over time. For a better understanding, readers can refer to Table 1 and Figure 3.

### Literature

There are many theoretical and empirical studies on electronic markets<sup>8-20</sup> and e-auctions<sup>21-24</sup>. Earlier studies reported impact of IT on markets in terms of changes in transaction costs to predict shift of buyers and sellers from one market place to another<sup>8,16</sup>. These studies recommend introduction of IT-enabled markets to improve communications, searches, monitoring and information-sorting capabilities and reduce transaction costs that will benefit both sellers and buyers.

Building on transaction costs and information-processing models<sup>25</sup>, this article compares the differences in key market processes using a process stakeholder analysis framework for comparing traditional non-e-markets with e-markets of Karnataka. Analysing the impact of e-markets in this framework helps decision-makers select better design for the maximization of benefits through e-markets.

While analysing markets, liquidity, volatility and transparency need to be considered as indicators of market performance<sup>26</sup>. Liquidity in agricultural markets is defined by more number of sellers and buyers or more market arrivals indicating wider participation by buyers and sellers. Volatility refers to the variance in day-to-day volumes and prices, and transparency refers to free information flow of market prices among buyers and sellers, and free and wider access to trading. The desirable markets are with high liquidity, low volatility and high transparency.

The literature shows that IT has the ability to lower coordination costs without increasing the associated transaction risks. Lee and Clark<sup>15</sup> studied the impact of the electronic marketplace on transaction cost and market structure. However, initial adoption of electronic markets was slow and many failed due to several social, economic and organizational barriers in the traditional societies.

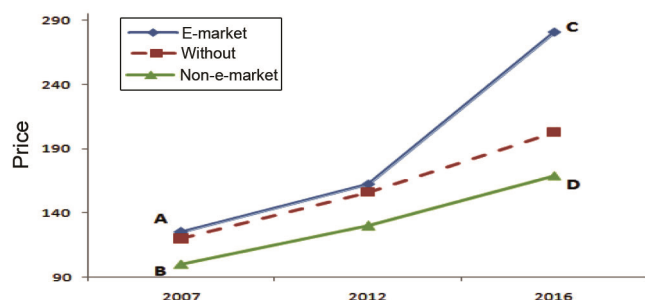
Traditionally, APMC markets follow open auctions, where commission agents publicize the produce to the traders and ask for bidding from them progressively from the lowest to the highest price in successive bidding rounds, until the single highest bid (buyer) prevails for the lot in the market. Here there are chances of collusion and understanding among the traders not to bid for a higher price and bid at mutually agreed lower price, to reduce final price released by farmers as only registered traders (who know each other) in the local market participate in the bidding. As a result, the price discovery does not take into account the national demand and supply conditions and market prices remain lower during the peak harvest season<sup>27,28</sup>. Once most of the farmers sell to the traders and the produce is with the latter, the prices start increasing based on free market forces.

In the e-auction platform, there is an option for direct display of commodities by farmers to potential bidders, or they can take help from commission agents to display to potential bidders (traders/bidders not only from local

**Table 1.** Interpretation of difference-in-difference regression parameters

Regression coefficient	Calculation*	Interpretation
$B_0$	$B$	Base year price in non-e-market (control group base price; before e-market)
$B_1$	$D - B$	Price change in non-e-market (in control group)
$B_2$	$A - B$	Difference between two groups before introduction of e-market
$B_3$	$(C - A) - (D - B)$	Difference in change in prices over time

\*Geometric coefficients calculation based on Figure 3.



**Figure 3.** Difference-in-difference approach to assess the impact of e-market.

markets, but also from across the state) who are potential buyers for auction. Traders from across the state compete by submitting bids for each lot by stating their price, and hence there is no possibility of collusion and cartel formation among traders and commission agents. Here also mostly progressive bidding is followed, eliminating bidders until only a single bidder remains for each lot<sup>18</sup>. With the wider adoption of e-auction platform, there is the possibility of increase in robustness, transparency, automation and effectiveness, and reduction in transaction costs which reduce malpractices<sup>23</sup>. E-auctions are most suitable if there are more number of potential buyers who can bid for non-standardized goods like agricultural commodities with unstable prices<sup>23</sup>.

Statistical evidence on farmer’s participation in e-auction and e-commerce is rare. In 1999, only 15% of US farms with internet access used it for e-commerce<sup>29</sup>. In northern Germany, in contrast, more than three-quarters (78%) of commercially viable farms that are online, used the internet for banking and financial transactions at the end of 2000; however, only 28% of the farmers with internet access made purchases on the web, and even fewer (19%) used the web for selling farm products<sup>30</sup>. However, during the past decade electronic markets have become popular for many commodities, e.g. there are some best-running e-markets like those for grains in China, flowers in Holland and fish in Thailand.

There is a lot of churning taking place in e-markets. The rise of new e-market platforms, closure of existing and newly created e-market platforms indicate that the e-markets need to pass through a series of trial-and-error processes to have a wider impact<sup>31</sup>. To understand the factors behind the success and failure of e-markets, we

take the case study of Karnataka model of e-markets, which was implemented and has evolved since 2007.

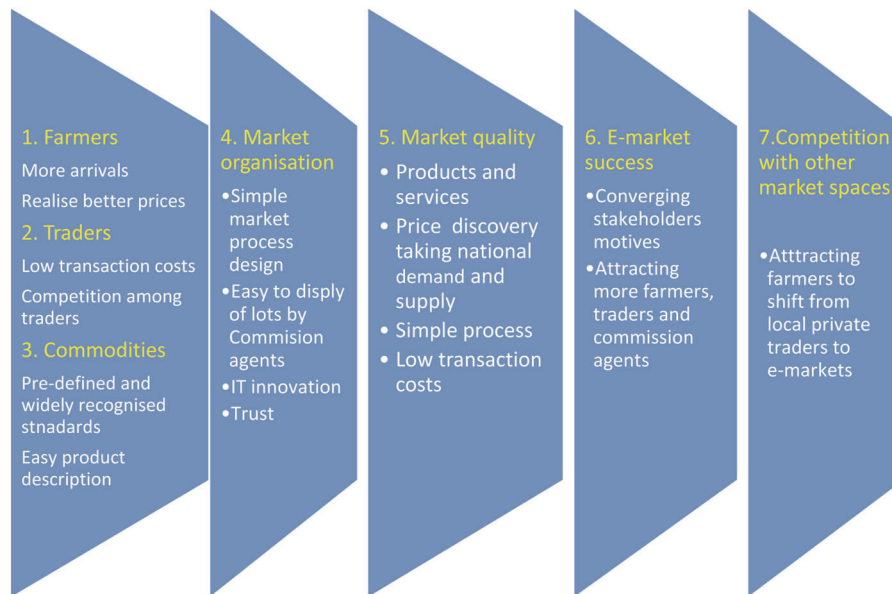
## Results

### Karnataka e-markets

Among all states, Karnataka was progressive in the implementation of these reforms, including e-markets. It introduced e-tendering in 2007 and further upgraded to e-markets with the establishment of unified market platform (UMP) in public-private participation (PPP) mode by forming special purpose vehicle – the Rashtriya-e-Market Services Private Limited (ReMS) in 2014, as a joint venture between the Government of Karnataka and NCDEX e-Markets Limited. Under this model, the existing regulated markets were converted into e-markets, with the software and day-to-day management provided by ReMS. Under this UMP, traders from anywhere can participate in the bidding at a particular e-market through online e-auction, without physical presence. It combines the decision-making and technical expertise of the private sector and public sector accountability with assured fee of 0.2% of the total turnover of e-markets to ReMS. ReMS provides automated auction and infrastructure facilities like weighing, invoicing, market fee collection, accounting, assaying facilities, warehouse-based sale of produce, commodity funding and price dissemination. E-markets were introduced in three phases. In phase-1 (2012–13), only 13 markets were brought into e-auction, in phase-2 (2013–15) another 44 markets and in phase-3 (2016–17) all 155 APMC markets were brought under e-markets. Now there are about 39 lakh farmers and 18,000 commission agents registered on UMP, with more than Rs 45,000 crore transactions for 68 lakh lots. A few e-markets (40 out of 155 e-markets) provide assaying facilities free of charge. Paddy, copra, groundnut, arecanut, tamarind, jowar, cotton, turmeric, ragi and horsegram are the major commodities traded in UMP.

### Socio-economic issues in e-market success

The utility of any e-market depends on its design and implementation and socio-economic acceptance. Many studies have highlighted the importance of design, but only a few have dealt with socio-economic complexities.



**Figure 4.** Classification of socio-economic issues for the success of e-markets.

Ribbers *et al.*<sup>7</sup> adopted a methodology to classify various complex socio-economic issues which affect the success of e-markets versus alternative marketplaces. There are seven elements, viz. (1) farmers, (2) traders, (3) commodities, (4) market organization, (5) market quality, (6) e-market success and (7) competition with other market spaces which determine the success of e-markets (Figure 4).

**Farmers:** Farmer's choice among different marketplaces like e-markets, village traders, commission agents and money lenders depends on expected realization of prices, transaction costs and services provided by the markets. The advantage with e-markets is that they provide wider choice to farmers with respect to buyers not only from local markets but bidders from across the state with immediate payment. However, some farmers fear about the recovery of loans (principal and interest) once transacted money is deposited into their existing bank account. To alleviate this fear, there is a need for opening trade accounts to farmers in e-market associated banks. However, some farmers still prefer village private traders as they are more convenient, with no procedures, market fee and provide doorstep services compared to e-markets. If the e-markets provide sufficiently higher prices to farmers, then they may shift from local traders to e-markets.

**Traders and commission agents:** Successful e-markets depends on the wider participation of bidders (traders) not only from local market area, but from faraway places like large institutional buyers such as millers and modern retailers. However, e-markets have some inherent problems like dependence on third-party assaying system rather than physical verification for quality determination

as preferred by the traders. E-market do not provide doorstep purchase and credit facilities like village private traders. In traditional markets, commission agents provide various services to the farmers on a long-term basis (providing credit linked to commodities). With e-markets, these long-period linkages have been broken and hence commission agents are against the e-markets. Further in the e-markets, traders have to pay upfront for their purchases, while earlier they did most of the business on credit with the commission agents. To overcome these problems, bank loans to traders and commission agents for upfront payments to farmers need to be explored. Institutional innovations to provide market services through alternative channels to farmers need to be explored.

**Commodities:** Not all commodities are suitable for e-markets. Only non-standardized and non-perishable commodities with unstable prices are suitable for e-markets. Commodities with government procurement at minimum support price are also not suitable, since price discovery is not based on free market forces.

**Market organization:** This includes the structure of important market processes, such as price discovery mechanisms like bidding process, information dissemination, and logistic arrangements like storage, weighing, primary processing and assaying facilities. It describes how different operations are performed and coordinated. In the case of e-markets, the government manages them through APMC in PPP model. The success of e-markets depends on simple and easy-to-use processes to all the stakeholders, especially farmers. E-markets eliminate much of the paper handling and clerical work associated with transactions: processing the bids, billing the farmers,

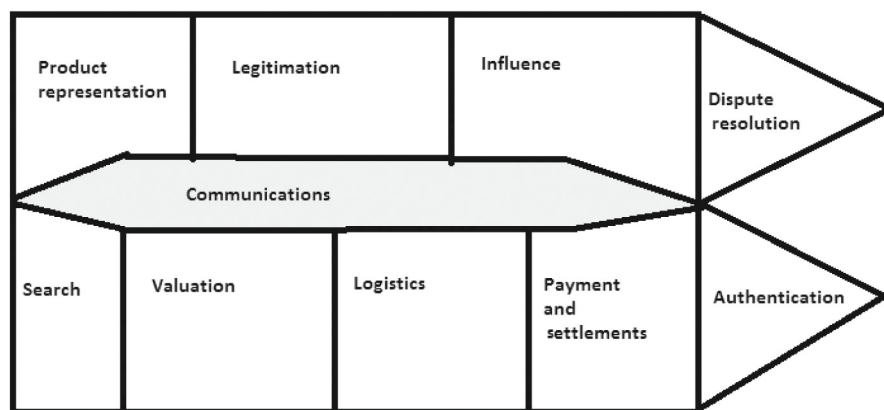


Figure 5. Process stakeholder analysis.

tracking the delivery, and accounting. E-markets have automated much of this work; now it is faster and error-free. Traders and commission agents are the two pillars of market organization. The commission agents are intermediaries who facilitate transactions and take commission (up to 2%) over turnover, which is recovered from the trader's payments. While traders are the buyers, who in turn sell to either consumers or wholesalers/retailers. Uninterrupted IT innovation solutions and bandwidth are important for faster transactions. At present, more than 60% of the first sale by farmers is through village traders, local commission agents, and money lenders. Success of e-markets depends on attracting farmers from other marketplaces for the sale of their produce.

*Market quality:* This refers to efficiency and effectiveness of market operation and satisfaction of different stakeholders. It includes size of market arrivals, price received by farmers and its volatility, easy of transactions, trading process, speed and timeliness of deliveries and payments and transaction costs. With e-markets, all these indicators may likely improve but with additional cost of learning by all stakeholders. E-market design should reduce learning costs and time to farmers and traders.

*Electronic market success:* Success of electronic markets depends on the motives of (potential) participants and the level of achieving these motives. The successful e-markets should attract more sellers and buyers to the marketplace for the benefit of all stakeholders. However, our focus group discussions and market arrivals data show that there has been little increase in market arrivals, and not to the expected extent. Also, there is less cross-market traders' participation in e-markets.

*Competition with other marketplaces:* APMC markets were established in the 1960s and 1970s, but even now only 36% of the farmers are selling at these markets,

while 57% sell to local private traders and another 9% to input dealers. This indicates there is larger competition from local private traders and input dealers as buyers for the farmer's produce. Successful e-markets should retain the existing farmers and attract more farmers to shift from local private traders, which is a gigantic task given the very low transaction costs and no market fee and doorstep services provided by the local private traders.

#### *Process stakeholder analysis*

We adopted the Kambil and van Heck<sup>2</sup> model for process stakeholder analysis which includes five trade processes (search, valuation, logistics, payments and settlements and authentication) and five trade context processes (communications, product representation, legitimation, influence, and dispute resolution; Figure 5).

#### *Trade processes*

*Search:* Search for the highest bidders for farmers' produce in the agricultural markets is done by commission agents who take commission from the farmers; but this process is automated in e-markets.

*Valuation (price discovery):* This is done traditionally by commission agents through open auction in which only a few local traders will participate. In case of e-markets this is done using a computer program with progressive elimination of bidders, until the single highest bidder prevails through e-auction. In this the transaction costs are low and can match any number of buyers and sellers within no time.

*Logistics:* Some logistics was provided by commission agents and some by the market officials. Market officials provide a lot number along with other details like quantity,

quality of the produce, stay arrangements for farmers and third-party independent assaying, if opted for. Commission agents provide loading and unloading, weighing, cleaning and grading and display of commodity to potential buyers with a commission. In some modern markets, warehouse receipts and cold-storage facilities are also provided to the farmers. Under the Model Act, warehouses are declared as sub-market yards of e-markets, with potential for separation of informational and physical trading processes. This facilitates varied forms of market exchanges independent of possession of physical commodities. It reduces coordination costs and increases communication capabilities and attracts buyers from distant places.

*Payment and settlements:* Traditionally payments were guaranteed by commission agent to farmers. In turn, they would get payment from the traders; this took several days or even months. However, in case of e-markets, there is a third-party guarantee in terms of exchange guarantee and hence there is elimination of counter-party risks. The payments received from the traders will be entered into the exchange account; from the exchange account the payment goes directly to the farmer's account after deducting commission and other charges on the same day by 2.00 p.m. This is a big positive for the farmers, as they can return home on the same day.

*Authentication:* In traditional APMC markets, there is no authentication of quality of the produce by third party; however, in e-markets authentication of quality and grading is done by independent third-party assaying agencies. However, this is not implemented in all e-markets. Many farmers and traders opine that assaying systems are more time consuming, hence prefer physical verification of commodities. The IT and assaying systems need to be technologically upgraded so that the assaying can be done within a few seconds at the entry gate itself.

#### *Trade context processes*

*Communication:* This is the information flow among all stakeholders related to trading activities. Traditionally, commission agent is the main information provider to farmers and traders. In e-markets, information is generated automatically and disseminated through TV scrolling, SMS, e-mail, etc. in addition to websites like [www.agmarknet.org.in](http://www.agmarknet.org.in), this is more efficient with less cost and scalable without any additional costs. However, focus group discussions reveal that e-markets are not able to generate peer information during the open auction process, based on which traders can adjust their subsequent bid prices. This loss of information results in less informed bidding by traders in e-markets. However, this can be overcome by displaying scrolling screens of prices of different markets.

*Product representation:* This is the display of commodities in standard form, so that the quality of the produce is easily understandable to all market participants. This is generally done by standardization and harmonization of grades and physical verification in the markets. Product description and harmonization of standards and assaying facilities allow the standardized description of products which can be easily understood by buyers and sellers<sup>32,33</sup>, and thus reduces transaction costs<sup>34</sup>. In e-markets, the role of product representation increases significantly, as traders from across India will be able to know the quality of the produce without physical verification before bidding from distant places. According to some farmers and traders, they miss the atmosphere and peer information flow of auction rooms. While others liked the relaxed atmosphere and trading at a distance from their own chambers.

*Legitimization:* This is the validation of the trade or exchange commitment. It is generally done through issue of sale certificate by the market committee in traditional APMC markets, while in e-markets it is done by announcement of final bidder and system-generated e-receipt and e-permit and SMS to all market participants.

*Influence structures and processes:* There is a need for enforcement of obligations and penalties to eliminate the opportunistic behaviour of market participants. This is done through proper incentives, sanctions and building mutual trust among farmers, traders, and commission agents. There is a need for strict enforcement of penalties for delivery of sub-standard commodities, non-payment or delay in payment of money in e-markets.

*Dispute resolution:* In markets, conflicts arise during transactions and thus there is a need for proper dispute settlement mechanism. There is no difference in dispute settlement mechanism between traditional APMC markets and e-markets. However, e-markets have authentic evidence for all transactions; hence there is less number of disputes and these can be easily settled with evidence. However, some traders and farmers feel that the disputes can be settled easily in non-e-markets compared to e-markets with mutual understanding.

#### *Impact of e-markets*

Table 2 provides administrative data of e-markets compared to non-e-markets. The year 2008 was taken as base year (before intervention of e-market in the state) as e-markets were introduced in the year 2012–13. Although e-markets were functioning since 2012, it took 3–4 years for their visible impact; hence we have taken 2016 as the post-project period. However, some APMC markets



**Table 2.** Impact of e-market on prices, arrivals and volatility of prices

Crop	Non-e-market (control)			e-Market (treatment)			Difference-in-difference (Columns 7 – 4)
	Before	After	% Change (Columns 3 – 2) × 100/column 2	Before	After	% Change (Columns 6 – 5) × 100/column 5	
	Average price (Rs/quintal)	Average arrivals (tonnes/month)		Average price (Rs/quintal)	Average arrivals (tonnes/month)		
1	2	3	4	5	6	7	
Copra	3,899	8,156	109	4,197	11,420	172	63
Rice	1,338	2,220	66	1,702	3,000	76	10
Groundnut	2,243	4,205	87	2,099	4,776	128	40
	Average arrivals (tonnes/month)			Average arrivals (tonnes/month)			
			% Change			% Change	
Copra	772	630	-18	3,145	10,946	248	266
Rice	1,309	1,946	49	5,343	11,404	113	65
Groundnut	1,301	3,240	149	4,305	18,950	340	191
	Volatility in prices (coefficient of variation %)						
Copra	22	49	124	8	17	100	-24
Rice	29	37	25	29	39	32	7
Groundnut	23	24	1	20	17	3	2

‘Before’ indicates prices before introduction of e-auction (in 2008) and ‘after’ indicates after introduction of e-auction (in 2016).

**Table 3.** Results of difference-in-difference regression analysis

Item	Copra		Rice		Groundnut	
	Coefficients	Significance	Coefficients	Significance	Coefficients	Significance
Prices (Rs/quintal)						
Constant	2436	0.00	1019	0.00	1830	0.00
Time (year) ( $\beta_1$ )	572	0.00	163	0.00	279	0.00
Intervention (e-market = 1; non-e-market = 0) ( $\beta_2$ )	-1047	0.08	274	0.03	-269	0.15
Interaction between time and intervention ( $\beta_3$ )	530*	0.00	27	0.37	68*	0.04
Adj. $R^2$	0.50	0.00	0.37	0.00	0.59	0.00
Number of observations	170	0.00	378	0.00	303	0.00
Arrivals (tonnes)						
Constant	1030	0.02	1515	0.01	472	0.90
Time (year) ( $\beta_1$ )	84	0.42	30	0.73	89	0.89
Intervention (e-market = 1; non-e-market = 0) ( $\beta_2$ )	1314	0.64	-27	1.04	2385	0.55
Interaction between time and intervention ( $\beta_3$ )	800	0.23	996	0.22	1225*	0.04
Adj. $R^2$	0	0.00	0	0.00	0	0.00
Number of observations	170	0.00	378	0.00	303	0.00

remained as non-e-markets even in 2016, as e-auction was not implemented in them; these were taken as control group. In some APMC markets, e-auction was introduced in 2012; these were taken as treatment group. We have selected two indicators, namely average price (Rs/quintal) and average arrivals (tonnes/month) to assess the impact. The increase in prices and market arrivals was more in the e-markets (treatment group) compared to non-e-markets (control group) for all three commodities. This indicates that the e-markets have a positive impact on prices and market arrivals.

The regression results also show that the e-markets have a positive impact on both prices and market arrivals (Table 3). This indicates that the farmers benefited from higher prices while the traders and commission agents

benefited from higher market arrivals. In case of prices, although signs are positive for all three commodities, they are significant for only copra and groundnut. In case of paddy it is not significant, probably due to implementation of minimum support prices in all markets (both e-markets and non-e-markets). In case of market arrivals, only groundnut showed significance at 5% level. This indicates that the positive impact of e-markets is more on prices than market arrivals.

*Exploratory analysis*

We have conducted focus-group interactions with farmers, traders, commission agents and administrative staff

**Table 4.** Awareness about e-market operations

Operation	Villages located less than 5 km distance from e-market			Villages located more than 5 km distance from e-market		
	Farmers	Traders	Commission agents	Farmers	Traders	Commission agents
Implementation of e-auction	81	100	100	32	80	90
Computerized entry at the gate	75	80	100	30	72	80
Computerized entry at the gate is mandatory	65	77	100	26	25	35
Highest bidder will win the bid	35	98	95	14	33	38
Bid results declared at 1.30 pm	75	93	94	30	20	31
Direct payment to bank account through on-line system	65	100	100	26	23	12
Opinion about e-auction						
Good	75	49	44	65	35	43
Not good	16	35	41	10	35	34
Do not know	9	16	15	25	30	23

Source: Field survey.

**Table 5.** Opinion of farmers, traders and commission agents

Opinion	Percentage of the respondents
<b>Farmers</b>	
<b>Advantages</b>	
Reduced collusion among traders (57%)	57
Inter-locked credit and commodity markets reduced	60
Transparency increased	90
Timely payment	95
<b>Disadvantages</b>	
Did not understand the process	45
Fear of deduction of loan (principal and interest) by banks	80
<b>Traders and commission agents</b>	
<b>Advantages</b>	
Direct money transfer to commission agents	90
Easy to use	80
Less procedural hurdles and paper work	90
Timely account transfers from traders	100
<b>Disadvantages</b>	
Some traders do not have computers, but facilitated by officers or through internet centres	40
Fear of taxation of traders	45
Slow broadband connectivity	57
Sudden shutdown of the system (partial implementation)	60

Source: Field survey.

of five e-markets and four adjacent villages (grouping villages based on distance from the e-markets) to get their opinion (Table 4). Majority of the farmers were aware of e-auctions and computer entry at the gate in the adjacent villages to e-markets (less than 5 km from the e-market), but in the villages more than 5 km from the e-markets, less than one-third of the farmers knew about e-markets. Many of the farmers in adjacent villages also did not know about the bidding process followed in e-markets. Overall, 75% of farmers, 49% of traders and 44% of commission agents said the e-market concept is good among the adjacent villages. Majority of the traders and

commission agents in both adjacent and far-away villages did not favour e-markets, but majority of the farmers found it to be good.

#### *Opinion on e-market operations*

About 57% of farmers said that e-markets helped in reducing the collusion among traders; 60% informed that it reduced interlocked credit-commodity market linkages, while 90% said that transparency increased (Table 5). About 95% of the farmers informed that they got timely

payment. While 45% of the farmers reported that they did not understand the process flow of e-markets, and 80% expressed fear about deduction of their loans (principal and interest) from payments received from e-markets.

About 80% of the commission agents and traders mentioned that it is easy to understand and use e-market. All commission agents and traders mentioned that there was timely account transfers online, 90% said that there was less procedural hurdles and direct money transfer to their accounts.

Among traders and commission agents, only 40% mentioned that they do not have computers, but were facilitated by the officers of the e-markets and that they put their bids from internet centres established near the e-markets after introduction of the scheme. About 45% expressed fear of taxation of income from their accounts, as now every transaction is visible and transparent and done online with Aadhar-linked bank account. About 57% informed about slow broadband connectivity, and 60% mentioned that there was a sudden shutdown of the system resulting in partial implementation of the scheme. Although in all the e-markets there are centralized generators for uninterrupted supply of electricity, these are not functional in some e-markets.

## Conclusion

For the success of e-markets, they have to satisfy the conflicting interests of all participants (including farmers, traders and commission agents); if one group is not satisfied with the e-markets, the entire system will fail<sup>5</sup>. Further, it is also important to attract farmers who are selling to village private traders to shift to e-markets to increase arrivals and better price discovery. There is a need for change in the design of the e-markets to reduce the time taken for gate entry and assaying, and also need for enhancing ways for peer information exchange in trading. Simple and time-saving assaying facilities need to be installed in all e-markets. With e-markets, long-term relationships among farmers–trader–commission agents are broken, and some of the services like commodity-linked credit and storage facilities to farmers are no longer provided by commission agents. There is a need for providing alternative arrangements for such services to farmers. For example, Karnataka is already providing bank loans to traders at 14% per year (as opposed to the 2% per month loans available from the commission agents) in order to enable them to pay the farmers upfront. Karnataka has also created separate payment accounts for farmers to alleviate fear of loan recovery by banks.

Some specific suggestion from the study are (i) increasing awareness among farmers in campaign mode, (ii) uninterrupted and low cost Internet connectivity in markets, (iii) access to computers and mobile devices, (iv) easy-to-use mobile apps for traders and commission

agents, (v) setting up help desks through public–private partnership (PPP) mode, (vi) skill up-gradation for market functionaries, (vii) alleviate fear of taxation among traders and commission agents and (viii) solving conflicts of interest among different stakeholders.

The government should support e-markets to protect from the trade and commission agents, who are getting excessive benefits from the existing markets through cartel formation, until the number of e-markets increases sufficiently. E-markets increase competition among traders across India and provide a national marketplace for free and fair price discovery for agricultural commodities. This price information generated through e-markets can be disseminated through all information bulletins and TV channels and scrolling, so that it will be used as benchmark price for other non-e-markets.

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