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Performance analysis of electronic national agricultural markets: some evidence from Odisha

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Abstract This paper analyses the effect of electronic agricultural markets on commodity arrivals and price volatility. Compared to that in the period before the National Agricultural Market (eNAM), market arrivals of commodities declined later, average monthly prices increased, and farmers received lower prices on average. The paper also analyses the influences on farmers' decision to participate in electronic trading, and it finds that farmers' education, small landholding size, and age had a positive and significant effect on participation. The eNAM needs to include more markets, raise awareness about its features, and train farmers and traders to make their participation effective.

Keywords Agricultural markets, price volatility, market integration, eNAM

JEL codes Q02, Q13, Q18

Agricultural markets help to create forward and backward linkages in the economy that enhance growth in the farm and non-farm sectors (Acharya 1998; Vaswani et al. 2003). By balancing the demand and supply of agricultural products, agricultural markets protect producers and consumers from the adverse effects of price instability (Acharya et al. 2012). An increase in agricultural production does not necessarily improve returns to farmers, due to low income elasticity of demand and to depressed prices (because of high marketing cost, lengthy marketing channels, fragmented markets, and interlocked factor markets) (Planning Commission 2011; Chatterjee et al. 2020). Rather, the efficient functioning of agricultural markets improves price discovery, long-term investment by farmers, the welfare of both producers and consumers, and the proper allocation of resources for production and distribution activities (Chand 2012). An efficient agricultural marketing system requires adequate infrastructure facilities, transparency in transactions, and accountability of market officials, and it ensures higher market arrivals, efficient price discovery, and low price volatility (Acharya 2007).

However, agriculture markets are plagued by problems such as information asymmetry, collusion among traders, improper weighment, delays in payment, and poor infrastructure. Because the integration of markets is weak and the institutional arrangements poor, the prices of commodities traded are volatile and adversely affect farmers (Sekhar 2004; NIAM 2017). Farmers plan crops, credit requirement, and investment in farm activities based on the market information available, but smallholder producers lack timely access to market related information (Satapathy and Mishra 2020), and most sell their produce immediately after the harvest because they lack proper storage facilities, require cash to repay debts and pay labour wages, and need money for social ceremonies and their children's education (Sahu et al. 2009; Panda 2017).

To overcome some of these problems, electronic national agricultural markets conduct electronic auctions (e-auction), encompassing activities such as quality assessment, computerized lot allotment, public address mechanism, dissemination of market information, and conducting the e-auction in a

designated hall. To create a "one nation, one market" system, the Government of India introduced the National Agricultural Market (eNAM) in April 2016. The nodal agency implementing the eNAM is the Small Farmers Agri-business Consortium (SFAC) under the aegis of the Ministry of Agriculture and Farmers' Welfare, Government of India.

The Government of Karnataka introduced an electronic marketing system for paddy in the Mysore regulated market on a pilot basis in 2006–07. Later, in 2014, the state government launched the Rashtriya e-Marketing service in 105 markets in 27 districts. As Karnataka is the forerunner in introducing information technology (IT) in the trading of agricultural commodities, studies assessing the performance of eNAM were confined to this state (Chand 2016; Aggarwal et al. 2017; Pavithra et al. 2018; NABARD 2018) and focused on the process, conduct, and challenges of eNAM. A few studies found that the eNAM impacted commodity prices and market arrivals positively (Chengappa et al. 2012; Reddy 2018).

Research is needed on the performance of the eNAM in other regions of the country, too, however, and this paper critically assesses its performance in Odisha. Despite the structural transformation of the Odisha economy, agriculture continues to play an important role in its economic growth, contributing about 18.9% of the gross state value added (GSVA) and employing 48.9% of the total workforce (Government of Odisha 2019).

Agricultural marketing in Odisha

To improve the efficiency in marketing agricultural products and the price realization to farmers, the Government of Odisha introduced market regulations through the Orissa Agricultural Produce Markets Act, 1956, and many reforms to attract investment in setting up markets, improve infrastructure facilities, and decentralize the grain procurement system. Notwithstanding these reforms, only 50% of the marketable surplus of agricultural commodities is transacted through regulated markets; the rest is sold through other marketing channels such as village markets and cooperatives or procured directly by processors (NIAM 2017; Bisen and Kumar 2018; Chatterjee et al. 2020).

About 428 market yards work under the Odisha State Agricultural Marketing Board, Bhubaneswar. Each regulated market in the state serves 424 villages on average, more than the national average of 258 (Kathayat 2019). The open auction sale procedure cannot be used in many regulated markets in Odisha because of the small quantity of arrivals, lack of infrastructure, low trader participation, low production, transportation problems, weak regulatory mechanisms, and the lack of well-trained market staff (Gummagolmath et al. 2014; Purohit 2016; Krishnamurthy 2021).

The market fee collected from stakeholders is not uniform across the markets in the state. Most small and marginal farmers prefer to sell their produce in the periodic village markets because these are closer and the marketing cost is lower. But few periodic markets have the infrastructure to conduct transactions smoothly and ensure that farmers get a reasonable price for their produce (Gummagolmath et al. 2014).

To reap the advantages of the eNAM process, the Government of Odisha started integrating its regulated markets with the electronic platform. In the first phase (March 2017), 10 markets were integrated with the electronic platform, and 31 markets in the second phase (April–May 2020), but only 41 of 428 regulated markets in the state were linked (OSAMB 2021). About 1.6 lakh farmers, 4,981 traders, and 156 FPOs are registered to participate in the electronic markets located in different parts of Odisha (SFAC 2021). These statistics indicate that still many farmers and traders are not in eNAM-enabled markets despite the expansion of electronic agricultural markets over time.

Process flow of trade through the eNAM

To simplify the process of trade through eNAM and facilitate the transaction of commodities, the Government of India has developed the eNAM mobile app that farmers can use to trace real-time bidding of the crop produce (Chengappa et al. 2012; Shalendra and Jairath 2016; Pavithra et al. 2018). The app works in six different languages to simplify the process of trade through the eNAM. Trade takes place in six steps: gate entry, quality assessment, uploading produce information, declaration of the highest bid price, final weighing by market officials, and the generation of an exit gate pass.

Step 1 Gate entry

The market official generates a unique lot ID. The ID includes the farmer's name and address, commodity name, number of bags, and vehicle details.

Step 2 Quality assessment

Technicians assess the quality of the crop produce and weigh it.

Step 3 Upload produce information

The produce information, including the quality assessment certificate, is uploaded onto the eNAM website for e-auction by registered traders in the country. The auction process is shown on the display board.

Step 4 Declaration of the highest bid

After the auction, the highest bid for the farmer's produce is sent to their registered mobile number. If the farmer accepts the bid, the trading process moves to the next step.

Step 5 Final weighing

The market officials weigh the produce. The trader pays the market officials, who send it to the farmer's bank account. The transaction usually takes one or two working days.

Step 6 Exit gate pass

Once the trader has paid the farmer, the market official generates an exit gate pass and the trader takes away the consignment. Market officials supervise the entire trading process.

Data sources and methodology

The present study uses both primary and secondary data for analysis. A field survey was conducted with a reference period of 2018–19, covering 140 farmers, 40 traders, and 8 market officials. The primary data on the market participants was collected from two electronic agricultural markets—Kantabanji in Balangir district and Kunduli in Koraput district in Odisha during October–November 2019. These markets are located in different agroclimatic zones and trade a higher volume than other markets.

About 4,317 tonnes of crop ouput was transacted through all the electronic markets in 2017 (Government of Odisha 2019); Kantabanji accounted for 51.49% of this volume and Kunduli for 17.56%. During the survey, we randomly selected farmers from the list provided by the market committees and interviewed traders and market officials when they were available. Table 1 in the Appendix lists the electronic agricultural markets and commodities traded.

We compiled the monthly data on market arrivals and price of commodities from March 2013 to February 2021 from the AGMARKNET portal to analyse the effect of the eNAM. We divided the study period into the pre-eNAM period (March 2013 to February 2017) and the post eNAM period (March 2017 to February 2021).

We also conducted a comparative analysis of eNAM enabled and non-eNAM enabled markets for select crops. We captured the effect of the eNAM through the price volatility of four major traded commodities—brinjal, tomato, maize, and cashew nut. We calculated the price volatility (PV) using the formula

PV = standard deviation of the log of (P_t/P_{t-1})

where,

P_t= price of crop produce in the current month and

P_{t-1}= price of crop produce in the previous month.

The binary logit regression model was used to analyse the factors influencing the farmers' decisions to participate in the eNAM enabled markets. The logit regression model can be written as

$$L_i = \ln (P_i/1-P_i) = x_i'\beta + u_i \quad \ldots(1)$$

where,

L_i is the logit,

u_i is the stochastic error term,

P_i is the probability of farmers participating in trade through electronic platforms, and

x_i is the vector of independent variables.

The model is estimated by the maximum likelihood procedure. The likelihood can be obtained from a Bernoulli distribution with the probability of participation as $P(y_i=1) = F(x_i'\beta)$. The log likelihood function for the joint probability distribution is

$lnL = \sum_{i=1}^{n} y_i \ln[F(x_i^{'}\beta)] + (1 - y_i)\ln[F(x_i^{'}\beta)]$ ...(2)

where,

F(.) is the logistic cumulative distribution function.

Maximizing the log-likelihood function with respect to β provides the maximum likelihood estimators. The independent variables include the age of the farmer, age squared, years of schooling completed, computer literacy, distance from farm to market, and net operated area.

The marginal effect provides change in the probability of participaton of farmers in the eNAM due to one unit change in the explanatory variable. It is computed by taking partial derivative of the estimated function as

$\frac{\partial P_i}{\partial x_i} = f(x_i^{'}\beta).\beta_j,$

where,

f (.) is the probability density function.

Market arrivals and price of major commodities

The consistent time series data on arrivals and price for brinjal and tomato are available from Bahadajhola electronic market, turmeric from Tikabali market, maize from Nabarangpur market, and cashew nut from Paralakhemundi market. The average quantity of arrivals of major commodities during pre and post-eNAM periods is given in Table 1 and Figures 1 to 3 in the Appendix.

Relative to the pre-eNAM period, the market arrival of all five commodities declined in the post-eNAM period. Brinjal fell 80%, from 1528.6 quintal per month to 308.1 quintal per month. Tomato also fell 80%, declining continually from March 2013 to February 2021. The market arrival of turmeric in Tikabali market declined 9%. Maize is a major crop grown in Nabarangpur market jurisdiction, but arrivals declined on average. The estimated t-test on market arrivals for turmeric, brinjal, tomato, and maize is not statistically significant. The arrival of cashew nut declined on average, with a higher degree of variability, and it is statistically significant at 1% level.

These patterns imply that farmers did not bring their produce to electronic markets because they do not know of the eNAM or how to use the electronic auction platform. The field survey evidence shows that 45.71% of the sample farmers were not aware about the e-auction process of trade through eNAM enabled markets or its benefits, and they prefer to sell their products through marketing channels like private traders, regulated markets, and weekly markets.

Table 2 provides the average quantity of arrivals of select commodities in markets both linked to and not linked to the e-NAM. The details of select crops and markets are given in Table 2 in the Appendix. The arrival of maize and cashew nut was higher on average in non-eNAM-enabled markets than in eNAM enabled markets.

In non-eNAM enabled markets, the arrival of maize averaged 8792.97 quintal per month, 7.84% higher than that in eNAM-linked markets; the arrival of cashew nut was 13.18% higher. But the arrival of perishable commodities such as tomato and brinjal was higher in eNAM linked markets. Farmers sell their produce in eNAM enabled markets because they can dispose of it quickly and traders pay them immediately. However, the estimated values of t-test statistic for the market arrival of all the select commodities are not statistically significant.

Table 1 Market arrivals (quintal)

Crop	Market	Pre–eNAM	Post–eNAM	Change in arrival (%)	t–test	P–value
Turmeric	Tikabali	176.27	160.43	–8.99	0.3958	0.3470
Maize	Nabarangpur	9956.22	8153.02	–18.11	1.1708	0.1237
Tomato	Bahadajhola	1310.96	260.03	–80.16	14.0098	1.0666
Brinjal	Bahadajhola	1528.65	308.13	–79.84	14.8161	1.2374
Cashew nut	Paralakhemundi	76.50	35.20	–53.99	3.6771***	0.0003

Note * p<0.1 and **p<0.05 and ***p<0.01
Source Computed based on AGMARKNET (2021)

Table 2 Market arrival in electronic and non-electronic agricultural markets (March 2017 to February 2021, quintal)

Crop	Electronic agricultural markets	Non-electronic agricultural markets	% change in arrival	t–test	P–value
Turmeric	160.43	NA	NA	NA	NA
Maize	8153.02	8792.97	7.84	–0.4635	0.3225
Tomato	260.03	123.00	–52.69	8.6973	1.1838
Brinjal	308.13	154.37	–49.90	9.7968	3.0925
Cashew nut	35.20	39.84	13.18	–1.1092	0.1364

Source Computed by authors based on AGMARKNET (2021)
Note "NA" represents not available

Table 3 shows that relative to the pre-eNAM period, the average market price of major commodities increased in the post-eNAM period: that of cashew nut the most, 30.8%, from INR 9,337 per quintal to INR 12,213 per quintal; brinjal by 16.3%; tomato from INR 2,112 per quintal to INR 2,304 per quintal; and maize by 7.5%.

The market arrival of all these commodities decreased, but their prices showed an increasing trend over time (Figures 4–6 in the Appendix). The stakeholders differ on the possible reasons. Most sample farmers felt that crop production had fallen, affecting market supply and raising commodity prices. Electronic market officials claimed that the introduction of the eNAM raised commodity prices, but the data does not support the claim.

Table 4 shows that from March 2017 to February 2021, the average market price of all the selected commodities except cashew nut was higher in non-eNAM-linked markets. The average market price of maize was INR

Table 3 Market price of commodities (before and after eNAM, INR per quintal)

Crop	Market	Pre-eNAM	Post-eNAM	Change in price (%)	t-test	P–value
Turmeric	Tikabali	5271.70	5457.77	3.53	–0.6715	0.2525
Maize	Nabarangpur	1316.90	1415.20	7.46	–4.4220	2.8766
Tomato	Bahadajhola	2112.42	2304.33	9.08	–1.1540	0.1271
Brinjal	Bahadajhola	1919.43	2232.20	16.29	–3.1217***	0.0015
Cashew nut	Paralakhemundi	9336.95	12213.08	30.80	–3.7522***	0.0002

Note * p<0.1 and **p<0.05 and ***p<0.01
Source Computed based on AGMARKNET (2021)

Table 4 Average market price of commodities in electronic agricultural markets and non-electronic agricultural markets during March 2017 – February 2021 (Rs./Quintal)

Crop	Electronic agricultural markets	Non-electronic agricultural markets	% change in price	t-test	P-value
Turmeric	5457.77	NA	NA	NA	NA
Maize	1415.20	1664.47	17.61	-2.0237**	0.0243
Tomato	2304.33	2346.79	1.84	-0.6873	0.2476
Brinjal	2232.20	2302.32	3.14	-2.4703***	0.0085
Cashew nut	12213.08	11367.09	-6.92	4.1137	7.7736

Note "NA" represents not available; * p<0.1 and **p<0.05 and ***p<0.01
Source Computed based on AGMARKNET (2021)

Table 5 Price volatility in electronic and non-electronic agricultural markets

Crop	Electronic agricultural markets		Non-electronic agricultural markets*
	Pre-eNAM	Post-eNAM	
Turmeric	0.0353	0.0559	NA
Maize	0.0168	0.0221	0.1405
Tomato	0.1840	0.1944	0.1716
Brinjal	0.1407	0.1788	0.1310
Cashew nut	0.0419	0.0277	0.0505

Note "NA" represents not available; Pre-eNAM period: March 2013 to February 2017; Post-eNAM period: (March 2017 to February 2021); * pertains to the period March 2017 to February 2021
Source Authors' estimates.

1664.47 per quintal in non-eNAM-linked markets, 17.61% more than the INR 1415.20 per quintal in eNAM-linked markets, and it is statistically significant at 5% level.

Similarly, the average price of tomato and brinjal was slightly higher in non-eNAM-linked markets, and the price difference for brinjal was statistically significant at 1% level. The average price of cashew nut was slightly higher in eNAM-enabled markets, but it was not statistically significant. On average, farmers received higher prices in non-electronic agricultural markets.

Price volatility in eNAM-enabled and non-eNAM-enabled markets

Price volatility is an important indicator of the performance of agricultural markets. Table 5 shows the degree of volatility in the prices of major crops.

Relative to the pre-eNAM period, the volatility in the price of commodities other than cashew nut increased during the post-eNAM period: for turmeric, maize, and brinjal, price volatility was relatively high and for tomato, modest. In contrast, Sekhar and Bhat (2018) found little variation in the price of paddy, wheat, mustard, and cotton in the electronic agricultural markets of Haryana. For tomato and brinjal, price volatility was lower in non-eNAM linked markets; for maize and cashew nut, price volatility was lower in electronic agricultural markets.

Given the mixed evidence, the importance of electronic agricultural markets in reducing price volatility is not clear, and this also implies that market integration is not fully achieved. Perhaps the inclusion of more markets under the eNAM may help to stabilize the commodity prices across markets in the state.

Factors influencing farmers' participation in electronic markets

We use the binary logit regression model to analyse the factors influencing farmers' decision to participate in electronic agricultural markets. Table 6 provides the summary statistics of variables and Table 7 the results of the logit regression model.

Table 6 Summary statistics of variables

Variable	Mean	Std. Dev	Minimum	Maximum
Participation in eNAM (Yes/no)	0.50	0.5017	0	1
Age (year)	41.31	10.8779	18	77
Years of schooling completed	6.32	3.7728	0	15
Computer knowledge (Yes/No)	1.95	0.2187	1	2
Distance from farm to market (Km)	6.59	5.8004	0.5	30
Net operated area (acre)	4.02	3.4892	0.5	25

Source Field Survey

Table 7 Factor influencing farmers' decision to participate in eNAM

Explanatory variables	Odds Ratio	P>|z|	Marginal Effects (dy/dx)	P>|z|
Age	0.7679**	0.025	-0.0559**	0.016
	(0.0903)		(0.0232)	
Age square	1.0032**	0.022	0.0006**	0.013
	(0.0013)		(0.0002)	
Years of schooling completed	1.1044*	0.098	0.0211*	0.086
	(0.0663)		(0.0122)	
Computer knowledge	0.7251	0.727	-0.0681	0.727
	(0.6680)		(0.1949)	
Distance from farm to market	1.1425***	0.003	0.0282***	0.001
	(0.0514)		(0.0084)	
Operated area	0.8939*	0.075	-0.0237*	0.064
	(0.0563)		(0.0128)	
Constant	109.9573	0.167	-	
No. of observations = 140				
Log-Likelihood = - 85.4155				
LR chi2 (6) = 23.25, Prob>chi2=0.0007				
Pseudo R^2 = 0.1198				

Note Figures in parentheses are standard errors. * p<0.1 and **p<0.05 and ***p<0.01

About 50% of sample farmers participated in electronic agricultural markets. The average age of respondents was 41 years and they had reportedly completed six years of schooling. With a low level of education, only 2.0% of sample farmers had some knowledge of using computers for trading activities. Most sample farmers were small landholders; their net operated area averaged 4.0 acre. For the entire sample the average operated area ranged between 0.5 acre and 25 acre.

The dependent variable is a binary variable, which takes the value 1 if a farmer has participated in electronic trading and 0 otherwise. Among the factors, farmers' age and participation in electronic agricultural markets show a curvilinear relationship. Surprisingly, the likelihood of participation in eNAM-enabled markets decreases by 0.76 if the farmers are younger, which is statistically significant at 5% level. However, the odds ratio of farmer's age squared is greater than 1, and it is statistically significant, implying that the probability of participation in electronic markets is higher for older farmers than younger.

Education has a positive impact on participation. For every additional year of schooling, the odds of participation increases 1.10 times. In terms of the marginal effects of education, the probability of participation increases by 2.1%, and it is significant at 10% level; Chengappa et al. (2012) find a similar impact of education on participation. However, the effect of computer literacy was statistically insignificant.

Participation is not affected by location: the odds of participation increases with an increase in the distance from farm to market—5 km to regulated markets on average and 9 km to electronic markets, according to the field evidence. The size of electronic agricultural markets is larger, their facilities better, the probability that farmers would earn a reasonable price for their produce higher, and perhaps that is why farmers do not mind travelling the distance.

Farmers participate in markets that have better infrastructure (Manjunath and Kannan 2012; Shilpi and Umali-Deininger 2007; Khunt and Gajipara 2008).

Arrivals are higher in markets where facilities are better (Manjunath and Kannan 2012). New markets and modern amenities reduce wastage and earn farmers a reasonable price, and because modern facilities are price effective and efficient these attract bulk arrivals (Kerur et al. 2008). Farmers with a large marketable surplus would prefer to sell at distant markets because they would expect to sell larger quantities than at the farm gate and at a higher price (Fafchamps and Hill 2005).

The marginal effect of operated area on participation is negative and statistically significant at 10%, implying that small landholders participate in the eNAM to get a better deal than disposing their produce directly to intermediaries or traders within the village.

Farmers' perspectives on electronic agricultural markets

We analysed the qualitative response of the sample farmers on the aspects of electronic agricultural markets through the Likert scales. Over 50% of the sample farmers were either dissatisfied or highly dissatisfied (Figure 1), citing the lack of a cold storage facility as a major constraint, particularly for improving trade in perishable products like vegetables.

Only a few farmers and traders were provided training about the eNAM; most were unaware that electronic markets follow a process of trade that is different from the conventional trading process or that a mobile app is used for trading. The sample farmers mentioned that creating greater awareness about electronic markets and the trading process would improve participation and that marketing cost and time period for completion of trade have not declined after the introduction of the eNAM. The major crops grown within a market area are not included. All these issues constrain the successful implementation of the eNAM.

Traders' perspectives on electronic national agricultural markets

Traders link farmers and consumers, but only 15% of the sample traders were trained in trading through eNAM enabled markets. Many traders feel that price volatility, marketing cost, and the time required for marketing have not declined even after the introduction of the electronic marketing system. Although the average distance to eNAM-enabled markets is relatively high, traders prefer to transact their business activities through the eNAM because of the crop volume is large and transactions transparent (Figure 2).

Traders purchase agricultural produce based on the quality assessment report released by market officials—they have no direct contact with traders—but there are not enough market officials to assess quality. Only 25% of the sample traders were satisfied with the quality assessment reports by the market officials. And, like the farmers, traders were dissatisfied with the quality of the cold storage facilities in markets.

Electronic markets do not charge farmers a fee, but traders pay 1% of their total transaction as a charge. The sample traders consider this charge very high; lowering it would raise trader participation. Both traders and farmers reported that the fees collected in regulated markets are not uniform.

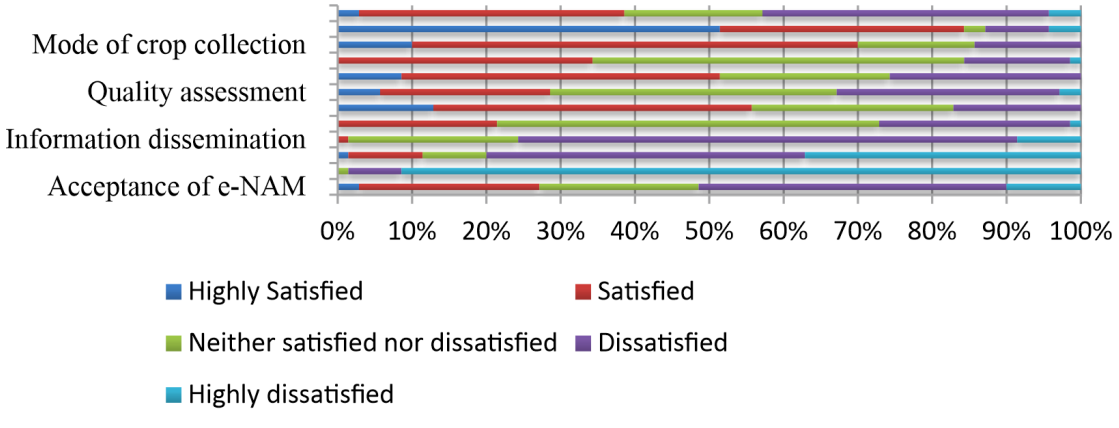

Figure 1 Rating of eNAM by sample farmers (%)
Source Field survey

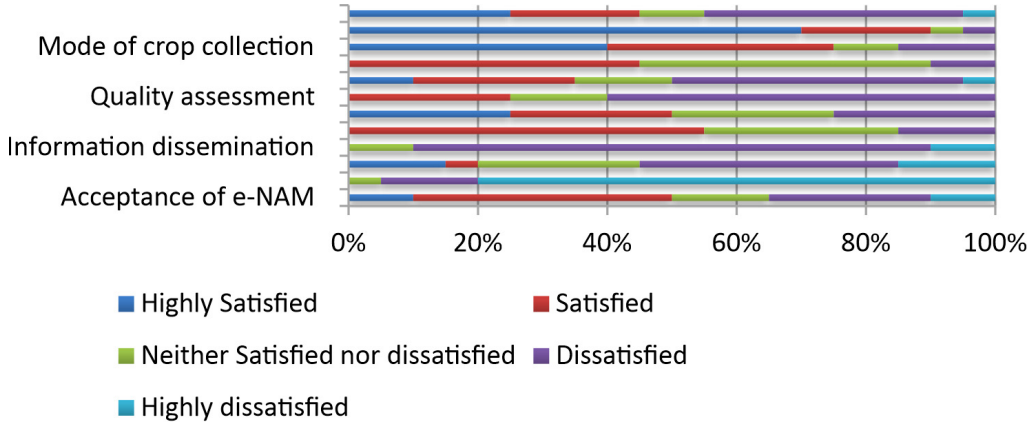

Figure 2 Traders rating of eNAM components (%)
Source Field survey

Conclusions and policy implications

This paper analyses the effect of the eNAM on price volatility, the factors influencing farmers' decision to participate, and the stakeholders' perspectives on how the eNAM functions.

Compared to that in the pre-eNAM period, the market arrivals of tomato, brinjal and cashew nut declined drastically in the post-eNAM period, but the price of these commodities increased over time and, in the post-eNAM period, the increase was volatile.

The increase was high for turmeric, maize, and brinjal, and modest for tomato. The rise in price volatility indicates that markets are not fully integrated and the inclusion of more markets under the eNAM may help to stabilize the prices to some extent.

Among the factors that influence participation, the effect of education and age squared was positive and statistically significant. Distance did not seem to affect the farmers' decision to sell their produce at eNAM enabled markets, as these were the large markets; nevertheless, proximity would reduce transportation and other related charges.

Compared to large landholders, small landholders participate more in electronic agricultural markets, but training farmers and traders in the training process of electronic market systems would help to improve participation considerably, as would the inclusion of the major agricultural crops grown within the market jurisdiction in eNAM-enabled markets.

The distribution of eNAMs by state is uneven: over 50% of the eNAMs are in Rajasthan, Gujarat, Maharashtra, and Uttar Pradesh (SFAC 2021). As on 28 February 2021, about 1,000 regulated agricultural markets in 21 states and union territories were integrated with the eNAM platform (SFAC 2021), and about 1.7 crore farmers, 1.57 lakh traders, and 88,000 commission agents—or only 14.4% of the 11.8 crore cultivators (Population Census 2011)—were registered. Interestingly, about 1,836 farmer producer organizations are registered in eNAM enabled markets; including them would create economies of scale and incentivize participation (Kumar et al. 2020).

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Appendix

Table 1 List of e-NAM enabled markets and major commodities traded in Odisha

Market	District	Major commodities traded through e-NAM
Kantabanji	Balangir	Onion, cotton, sunflower seeds
Kendupatana	Cuttack	Moong (whole) (green gram)
Paralakhemundi	Gajapati	Cashew nut, maize
Tikabali	Kandhamal	Turmeric, green peas
Kunduli	Koraput	Ginger, jackfruit, leafy vegetables, potato, sweet potato
Nabarangpur	Nabarangpur	Maize
Bahadajhola	Nayagarh	Bitter guard, brinjal, cauliflower, cucumber, lady's fingers, moong (whole), tomato
Sakhigopal	Puri	Coconut
Rayagada	Rayagada	Cotton
Kuchinda	Sambalpur	Chillies, mahua flower

Source Odisha State Agricultural Marketing Board (OSDAMB), Bhubaneswar

Table 2 Select crops and markets

Crops	eNAM-enabled markets	Non-eNAM enabled markets	District
Turmeric	Tikabali	Not available	Kandhamal
Maize	Nabarangpur	Umerkote	Nabarangpur
Tomato	Bahadajhola	Sarankul	Nayagarh
Brinjal	Bahadajhola	Sarankul	Nayagarh
Cashew nut	Paralakhemundi	Kasinagar	Gajapati

Source AGMARKNET (2021)

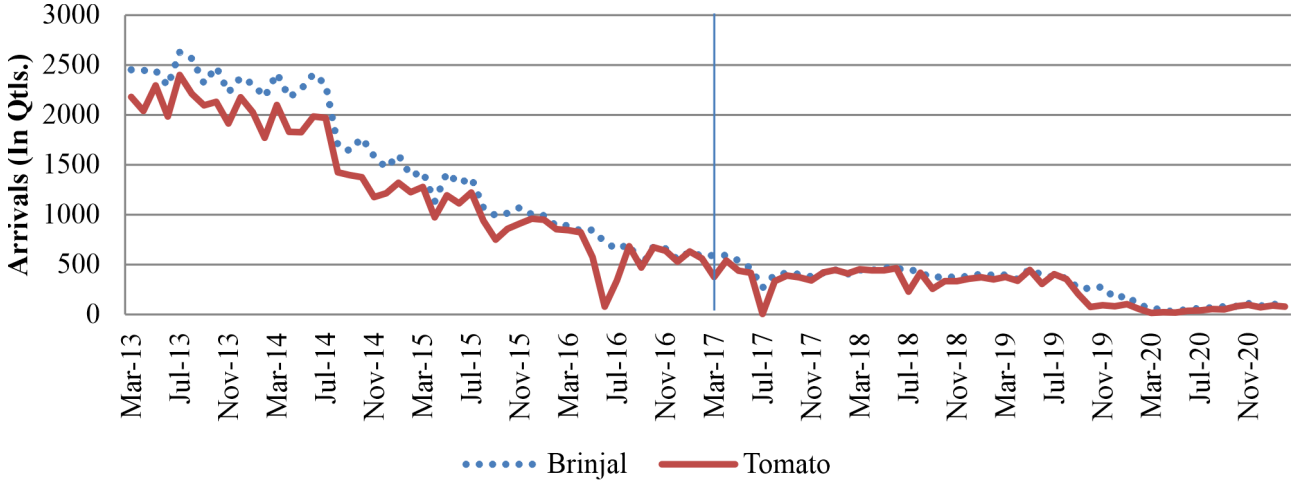

Figure 1 Trend of brinjal and tomato arrivals in Bahadajhola market
Note The vertical line distinguishes between the pre-eNAM and post-eNAM periods
Source AGMARKNET (2021)

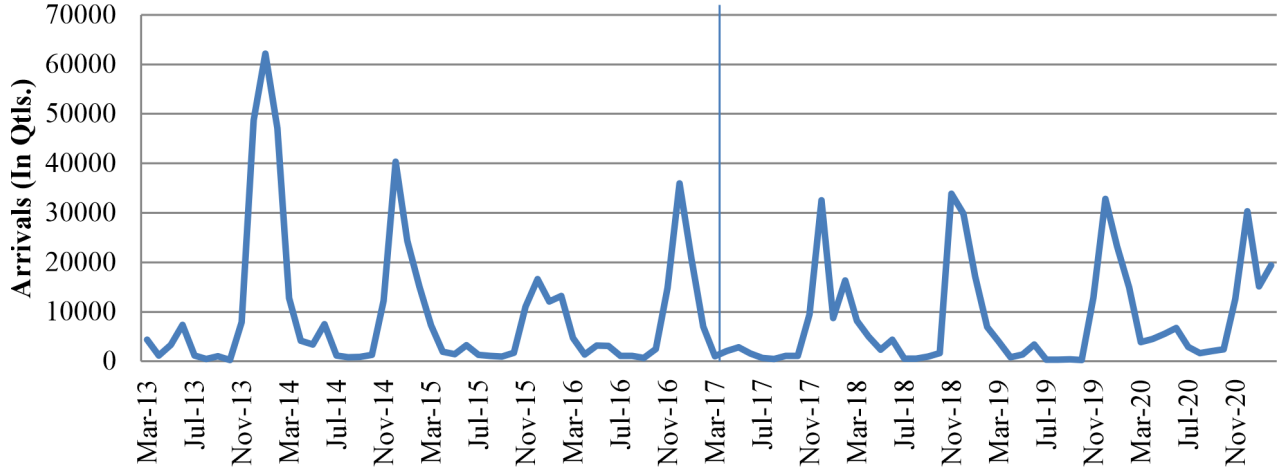

Figure 2 Trend in maize arrivals in Nabarangpur market
Note The vertical line distinguishes between the pre-eNAM and post-eNAM periods
Source AGMARKNET (2021)

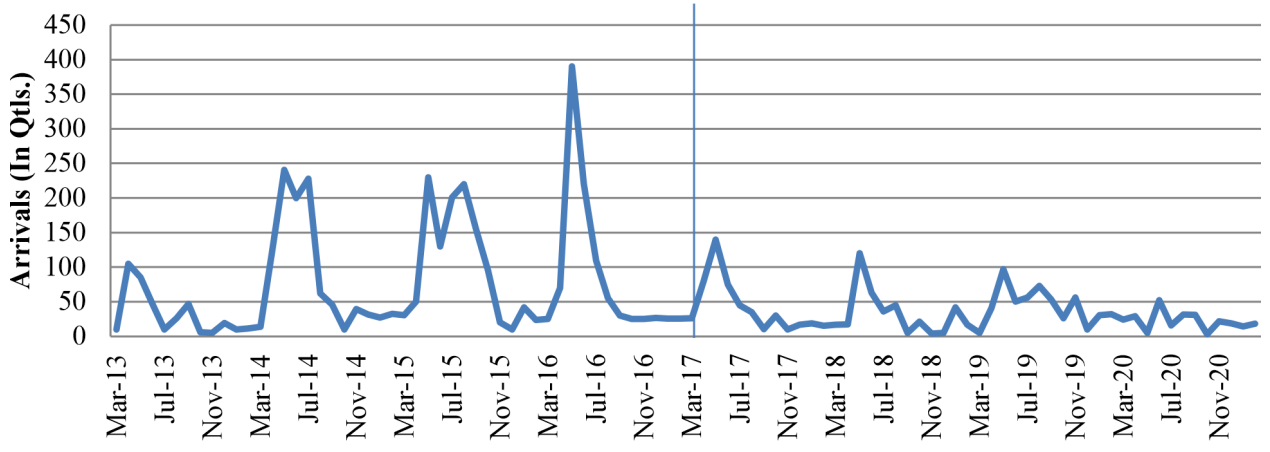

Figure 3 Trends in cashew nut arrivals in Paralakhemundi market
Note The vertical line distinguishes between the pre-eNAM and post-eNAM periods
Source AGMARKNET (2021)

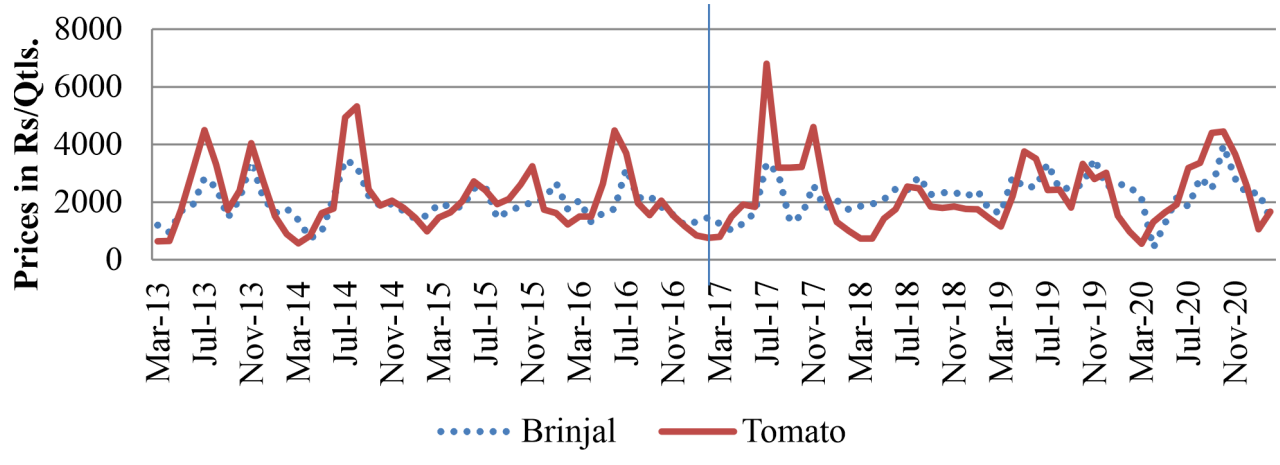

Figure 4 Trend in prices of crops in Bahadajhola market
Note The vertical line distinguishes between the pre-eNAM and post-eNAM periods
Source AGMARKNET (2021)

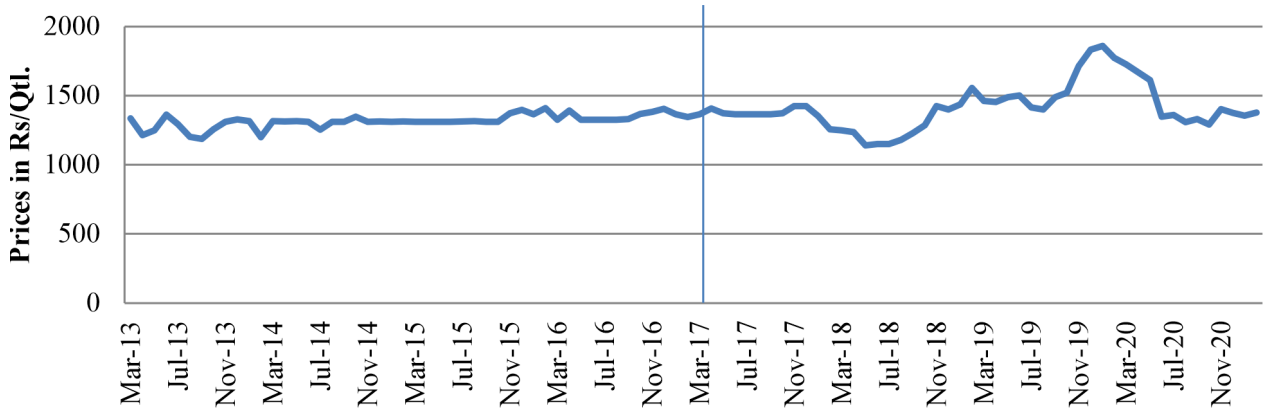

Figure 5 Trend in maize price in Nabarangpur market
Note The vertical line distinguishes between the pre-eNAM and post-eNAM periods
Source AGMARKNET (2021)

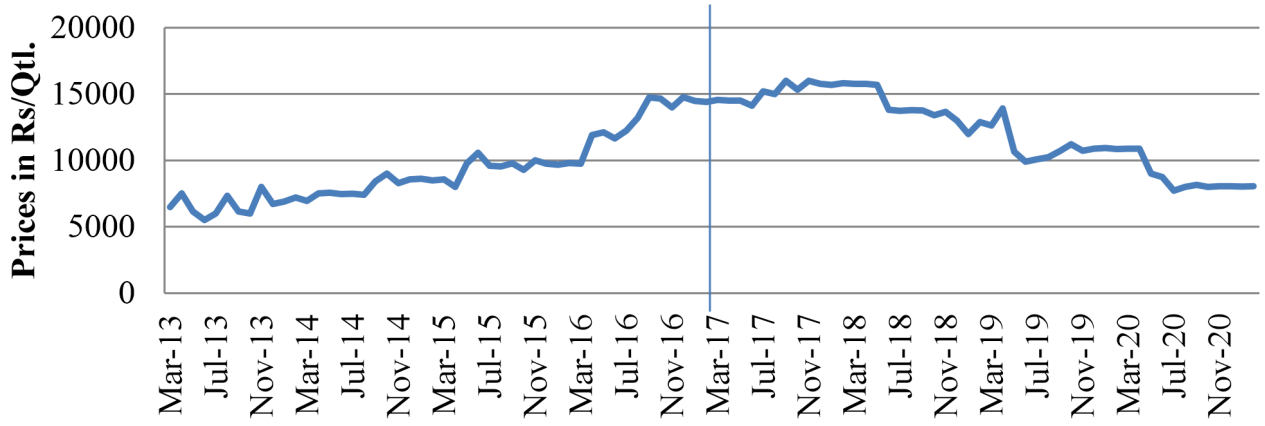

Figure 6 Trend in cashew nuts price in Paralakhemundi market
Note The vertical line distinguishes between the pre-eNAM and post-eNAM periods
Source AGMARKNET (2021)