

Electronic National Agricultural Market (e-NAM) A Review of Performance and Prospects

Chandra Sekhara Rao Nuthalapati

Institute of Economic Growth
New Delhi; Email: chandra@iegindia.org

Yogesh Bhatt

Agricultural Economics Research Center
Delhi University

Susanto K Beero

Institute of Economic Growth
New Delhi

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Agricultural Economics Research Unit

Institute of Economic Growth

University Enclave, University of Delhi (North Campus), Delhi 110 007, India
Phone: 91-11-27666364/6367, 27667101/7288/7365/7424, Fax: 91-11-27667410;

Website: <http://www.iegindia.org>

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Electronic National Agricultural Market (e-NAM)

A Review of Performance and Prospects

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Executive Summary

Reducing price spread between producer and consumer is one of the best ways of increasing farm income in the current milieu of agricultural marketing in the country. Enhancing productivity has its limitations and is not a sufficient condition for raising farm incomes (Narayanamoorthy, 2017; Rao et al., 2018). Raising productivity can likely depress prices in the face of all round spikes leading to higher overall production at the national level. On the other hand, reducing marketing costs by means of reducing the transaction costs and chain of intermediaries can leave better share of consumer rupee with the farmer-producer. The central government, quite understandably, expects to double farmers' income in ten years with a lions' share of contribution from better price realisation to the tune of 13 per cent based on the experience of electronic marketing scheme in Karnataka (Chand, 2017a).

The price realised by farmers increased the highest in recent history during 2004-05 to 2011-12 to a tune of 0.78 per cent per annum, leading to better incomes to farming community (Chand, 2017b). The poverty reduction during this period progressed at an unprecedented 2.2 per cent per annum and agricultural income growth has contributed significantly to this (Dev, 2016). However, this growth in income through price realisation has experienced a downside in terms of higher price inflation. Balancing interests of the producers and consumers by way of remunerative prices and cheap food respectively can be achieved through productivity rise and reducing the chain of intermediaries (Rao, 1994). While the Green Revolution made the first one possible with simultaneous reduction in food prices, the latter is yet to happen in India. This latter route is also important because this price spread between producer and consumer is a "black box" composed of wholesale, processor, and retail segments and this "black box" comprises roughly one-third of the total consumer price (Reardon and Gulati, 2008). It is important to note that the overall prices will be lower in both the above means, while at the same time making the farmers better off. The recent policy focus on politically sensitive agricultural marketing reforms is justified from the above concerns in the differential impacts of disparate pathways for better price realisation for farm produce.

These policies were immensely successful and by the mid- seventies India had become virtually self-sufficient in production of food grains and impressive gains have been made in the production of milk and sugar. However, agricultural marketing did not receive the required attention. Post- harvest management and development of efficient markets & supply chains have largely been neglected in policymaking. However, the recent policy trajectory is attempting to correct this through some important initiatives. The current policy focus on doubling farmers' income by 2022 can also achieve its desired objectives only by improving and vastly redesigning the existing marketing system in the country.

Marketing of agricultural commodities in India is carried out through the regional Agricultural Produce Marketing (Regulation) Acts in various the States and union territories. Under this system a vast network of regulated markets has been established. The basic objective of the APMC Act is to ensure an effective price discovery through interplay of supply and demand forces. Over time, however, these markets have become restrictive and monopolistic and have, therefore, failed not only to achieve their basic objectives but owing to restrictive provisions of States' APMC Acts prevented a seamless integration of farmers and buyers and evolution of an efficient supply chain.

Some of the major problems with the current system are the insufficient number of APMC markets and their inadequate Infrastructure, limited access to market for (small) farmers, less remuneration to the farmers and high intermediation cost, lack of market information / Information asymmetry, need to physically bring the produce to *mandi*, high incidence of market fee/ charges, fragmentation of markets, requirement of multiple licenses for trading, multiple point levy of market fee, existence of opaque/ semi-transparent processes of bidding and lack of emergence of alternative channels of marketing.

Impressed by the success story of the e-market in the Karnataka, the Government of India, introduced the electronic trading platform at national level called National Agricultural Market (e-NAM) on 14th April 2016 with an objective of one price in one market in one nation. Realising the urgent need to address the challenges of the existing agricultural marketing system the Union Government has introduced a Central Sector Scheme for Promotion of National Agriculture Market through a common electronic market platform, called the electronic National Agricultural Market or e-NAM. The e-NAM aims to integrate all the agricultural markets of the country and envisages a common national market for agricultural commodities with seamless movement across state boundaries. This is envisioned as a solution to marketing issues of all stake holders - farmers, traders, retailers, consumers and logistic providers. The NAM Portal provides a single window service for all APMC related information and services, including commodity arrivals, prices, bids & offers. The physical movement of agriculture produce takes place through the *mandis* while the online trading is expected to reduce transaction costs and information asymmetry.

Under the present scheme, about 585 regulated wholesale markets in various states and UTs are planned to be covered in the first phase. Union Ministry of Agriculture and Farmers' Welfare (MoA&FW) will meet expenses on software and its customisation for the States and provide it free of cost. DAC&FW is also giving grant as one time fixed cost (subject to the ceiling of Rs.30.00 lakhs per *mandi*) for related equipment / infrastructure and for installation of the e-market platform. The list of specific APMCs to be included in the list of 585 markets is to be provided by the State Governments.

A national electronic trading platform is conceived for transparent sales and price discovery initially in regulated markets and to be followed in *kisan mandis*, warehouses and private markets. It is mandatory for the States need to enact the following provisions in their APMC Acts for promotion of e-trading in their States to fulfill three conditions for starting eNAM VIZ., One license for a trader valid across all markets in the State; single point levy of market fees, i.e. on the first wholesale purchase from the farmer; and 100% online trading of the agri-produce selected for each *mandi*. Other requirements include harmonization of quality standards, provision for assaying and facilities for soil testing near mandis.

Against this background, the present study aims to study the functioning of electronic mandis in the country with special focus on the extent of realization of the expected benefits to farmers in terms of higher prices. The specific objectives of the study are to study the extent of operation, adoption and functioning of e-NAM in some of the major markets; analyze the improvements due to e-NAMs in price discovery, quantity traded and marketing cost, among other things; examine the infrastructure facilities at the e-NAMs for cleaning, sorting, grading and weighing of commodities; and assess the overall impact on the ease of doing business

The study employed both secondary and primary data. The secondary data on prices, market arrivals and bids/offers collected by various e-NAM mandis available with the Department of Marketing, MoA&FW, GoI are used to analyze the market trends before and after the introduction of e-NAM. The electronic mandis initially got a head start in six states viz., Uttar Pradesh, Madhya Pradesh, Haryana, Maharashtra, Telangana and Gujarat. Therefore, this study has focused on these states and

collected primary data from about 5% of these 341 markets- in about 21 mandis. The Agro-Economic Research Centres of the respective states conducted the primary data collection and analysis. Each AERC has visited the mandis selected and made a list of farmers and traders/Commission Agents registered at the mandi/market. Then a sample of 100 farmers, 25 traders and 25 commission agents selected randomly for survey in each state making the total sample to be of 856 farm households and 150 each of traders and commission agents from 338 villages in 23 districts across six states. A structured questionnaire is used for data collection. The data collected pertain to the major commodities traded in these markets, while focusing on grains and fruits & vegetables. The study is organised into five Sections. Section 1 elucidates the background, objectives and methodology of the study. Review of literature is given in Section 2. Analysis of price trends in pre and post-eNAM scenarios are compared using secondary data is illustrated in section 3. Section 4 examines price trends and volatility in the business as usual scenarios. The section 5 describes performance of e-NAM based on surveyed data. The last section concludes with major findings and policy recommendations.

As a prelude to the analysis of primary data, we analysed price trends of the select crop produce in the market yards before the introduction and after the introduction of eNAM by taking April 2015 to October 2017 as the pre-eNAM period and November 2017 to March 2018 as the post-eNAM period. Detailed analysis of the month-wise prices of these commodities in all the mandis shows that prices are on the decline across states for all the commodities put together except in Telangana. While the prices went down by 8.3% in Haryana, the contraction was as high as 26.8% in Gujarat. Further analysis through month-wise movement of prices indicates that there is no trend in either direction after introduction of eNAM in the farm prices. This sets the stage for us and would be useful as a counterfactual to proceed to the examination of prices received by the sampled households for their farm produce. On the other hand, we also collected information from the sampled households on the realised prices before and after eNAM adoption scenarios.

Among the sample respondent across states, the highest 42 per cent of respondent are in higher education in the state of Gujarat and Haryana, followed by 28% in Uttar Pradesh. 33 and 29 per cent of respondents are in high school in the state Madhya Pradesh and Maharashtra respectively. The highest 35 per cent of illiterate respondents are recorded in Telangana. Overall highest 29 per cent of respondents are reported to be in high school. In other words, 58% of the participants in eNAM have obtained high school or higher education. An examination of inclusiveness in selling through eNAM indicated that this intervention allows marginal (29%) and small farmers (25%) along with medium farmers (27%) and large farmers (18%). However, situation in some of the states raises some concerns of exclusion. For example, in Madhya Pradesh, large farmers (51%) and medium farmers (25%) alone constitute the bulk of sellers in the electronic market to the relative lack of marginal (5%) and small farmers (18%). The participation of smallholders is robust in Gujarat (80%), Telangana (65%) and Uttar Pradesh (65%). Interestingly, some of the landless labourers cultivating tenant lands also sold to the eNAM in UP, MP and Gujarat, albeit in small numbers. The participants farmers have an average landholding of 13.1 acres in MP followed by 6.2 ac in Maharashtra, 5.9 ac in Haryana, 4.7 ac in Telangana, 4.0 ac in UP and 3.7 ac in Gujarat.

Nearly half of the participant farmers opined that the testing of quality and the parameters used are liberal and 22% of them received a report on testing of quality. More than two-fifths (44%) of the participants perceive eNAM to be better than the manual mandi of the earlier days. While no one from MP and only 16% from UP are satisfied with the performance of eNAM, overwhelming proportion of farmers from other states are satisfied with the electronic marketing. The reasons for this poor satisfaction levels in MP and UP seems to be the lack of related infrastructure as evidenced by their responses in regard to the facilities. On the other hand, the e-auction facilities are found be good by large proportion of farmers in Haryana (75%), Maharashtra (99%), Telangana (100%). Lack of facilities for information sharing, grading, refrigeration, sorting, net connectivity and computers, soil testing and cumbersome online payment system along with delays are some of the problems reported by large proportion of farmers.

The participant farmers in the electronic market are happy with facilities for quality testing (61% of farmers), higher price realization (56%), transparent procedures (52%), lower cost of marketing (51%), easier selling process (49%), and satisfaction of being part of national market (47%). Relatively larger proportion of farmers used eNAM mobile app in Haryana (71%) and Maharashtra (56%), while it was almost non-existent in other states. Relatively higher proportion of the farmers reported that they receive sms alerts after the online transaction. There is scope to improve performance in this regard in UP in case of both the parameters and in several states for eNAM app.

We analysed the price realization for the participant farmers in eNAM through primary data from all the states rigorously and found that they received a 5.5% higher price by selling in electronic markets compared to the pre-adoption scenario. The counterfactual scenario through the analysis of price data for the select commodities before and after the adoption scenarios, shows that prices have declined for all the agricultural commodities. Juxtaposing the treatment and counterfactual scenarios, this study concludes that selling in the electronic market has the potential to enable higher prices to farmers through increasing competition and thwarting inefficiencies. Though the 5.5% higher price seems smaller, this is significant in the background of plummeting prices in the markets in general. Also, the price realization would improve as marketing infrastructure is improved in all the lagging states like MP and UP and further improvements in the better performing states of Gujarat, Haryana, Telangana and Maharashtra.

Further examination of the underlying factors for satisfaction with eNAM using logit regressions revealed that the availability of e-auction and bidding facilities and provision of quality testing report are positively correlated with satisfaction levels. Conversely, cumbersome price discovery process, difficulty and delays in online payment and lack of cleaning facilities proved dampeners for farmers' happiness with the electronic marketing. Another significant set of findings from Tobit analysis indicates that availability of irrigation facility, good and transparent quality testing, farmers being located in Haryana and price discovery process are positively associated with price realization relative to before adoption scenario. On the other hand, higher mandi fees, poor net connectivity, and stringent quality parameters stifle price realization significantly.

To conclude, the results of the study showed that participating farmers in the electronic market receive higher prices and 44% of them are happy and satisfied. The performance of this intervention is poor in states of central and north India, where infrastructure in general and marketing infrastructure in particular are relatively under-developed. Extending the eNAM to all the market yards in the country, developing standards, net connectivity, bidding facilities, transparent testing facilities, and ease of online payment system will go a long way in establishing eNAM as the preferred marketing option for the farm households. The recent investments by the government seems to be in the right direction in this regard. Further, raise of the online market from government side will act as a countervailing force to the steadily picking up private investments, some of which can be monopolistic if not oligopolistic in nature.

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1.0.Introduction

Self-sufficiency in agriculture has been a priority for Indian policymakers since the major droughts of the mid-1960s. Many programs have been launched to increase domestic production and decrease reliance on imports. A combination of input subsidies, output price support and trade restrictions was successfully adopted to attain self-sufficiency in foodgrain production. Many important institutions such as Agricultural Prices Commission (APC), which is now known as CACP, Food Corporation of India (FCI) and National Dairy Development Board (NDDB) were also established during this time. Large investments were also made in agricultural R&D. These policies were immensely successful and by the mid-seventies India had become virtually self-sufficient in production of food grains and impressive gains have been made in the production of milk and sugar. However, agricultural marketing did not receive the required attention. Post- harvest management and development of efficient markets & supply chains have largely been neglected in policymaking. However, the recent policy trajectory is attempting to correct this through some important initiatives. The current policy focus on doubling farmers' income by 2022 can also achieve its desired objectives only by improving and vastly redesigning the existing marketing system in the country.

Marketing of agricultural commodities in India is carried out through the regional Agricultural Produce Marketing (Regulation) Acts in various the States and union territories. Under this system a vast network of regulated markets has been established. The basic objective of the APMC Act is to ensure an effective price discovery through interplay of supply and demand forces. Over time, however, these markets have become restrictive and monopolistic and have, therefore, failed not only to achieve their basic objectives but owing to restrictive provisions of States' APMC Acts prevented a seamless integration of farmers and buyers and evolution of an efficient supply chain.

Some of the major problems with the current system are the insufficient number of APMC markets and their inadequate Infrastructure, limited access to market for (small) farmers, less remuneration to the farmers and high intermediation cost, lack of market information / Information asymmetry, need to physically bring the produce to *mandi*, high incidence of market fee/ charges, fragmentation of markets, requirement of multiple licenses for trading, multiple point levy of market fee, existence of opaque/ semi-transparent processes of bidding and lack of emergence of alternative channels of marketing.

1.1. e-National Agricultural Market (e- NAM): Realising the urgent need to address the challenges of the existing agricultural marketing system the union government has introduced a Central Sector Scheme for Promotion of National Agriculture Market through a common electronic market platform, called the electronic National Agricultural Market or e-NAM. The e-NAM aims to integrate all the agricultural markets of the country and envisages a common national market for agricultural commodities with seamless movement across state boundaries. This is envisioned as a solution to marketing issues of all stake holders - farmers, traders, retailers, consumers and logistic providers. The NAM Portal provides a single window service for all APMC related information and services, including commodity arrivals, prices, bids & offers. The physical movement of agriculture produce takes place through the *mandis* while the online trading is expected to reduce transaction costs and information asymmetry.

Under the present scheme, about 585 regulated wholesale markets in various states and UTs are planned to be covered by the end of March 2018. Union Ministry of Agriculture and Farmers' Welfare (MoA&FW) will meet expenses on software and its customisation for the States and provide it free of cost. DAC&FW is also giving grant as one time fixed cost (subject to the ceiling of Rs.30.00 lakhs per *mandi*) for related equipment / infrastructure and for installation of the e-market platform. The list of specific APMCs to be included in the list of 585 markets is to be provided by the State Governments.

1.2. The major components of NAM: A national electronic trading platform for transparent sales and price discovery initially in regulated markets and to be followed in *kisan mandis*, warehouses and private markets.

1. It is mandatory for the States need to enact the following provisions in their APMC Acts for promotion of e-trading in their States
 - One license for a trader valid across all markets in the State.

- Single point levy of market fees, i.e. on the first wholesale purchase from the farmer.
 - 100% online trading of the agri-produce selected for each *mandi*.
2. Harmonization of quality standards of agricultural produce and provision for assaying (quality testing) infrastructure in every market to enable informed bidding by buyers.
 3. Provision of Soil Testing Laboratories in/ or near the selected *mandi* to facilitate visiting farmers to access this facility in the *mandi* itself.

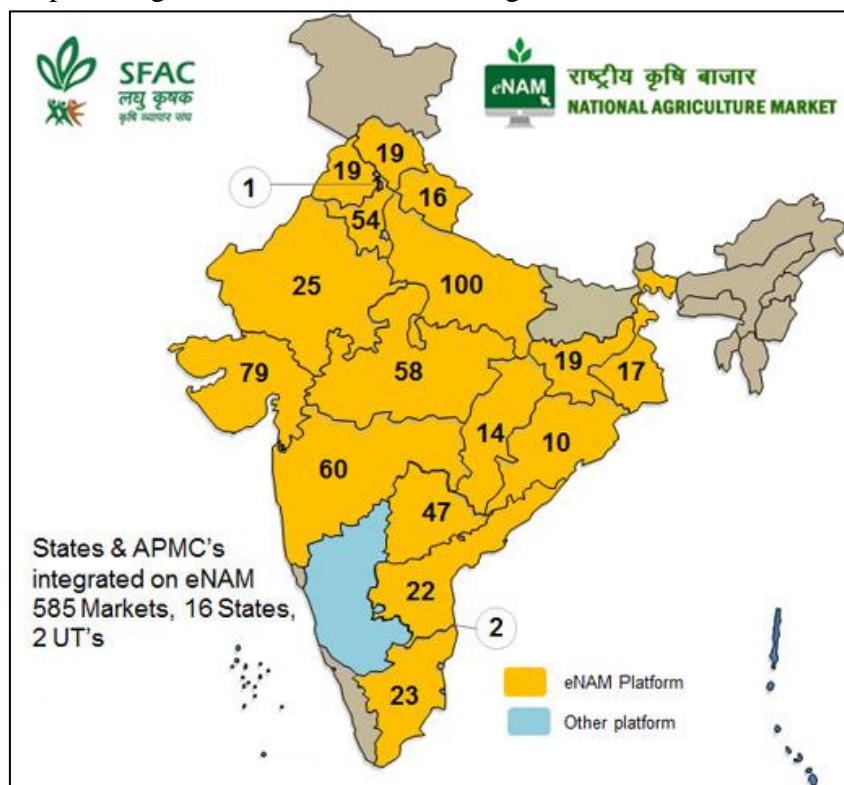
1.3. Expected Benefits of NAM to the farmers: Some of the expected benefits from e-NAM include accessibility of farmers to a common agriculture market; real time price discovery; transparency in the agriculture marketing system; reduce the transaction costs of buyers and sellers; real time information on prices, market arrivals etc; bidding on quality parameters of commodities; online bidding for more transparency; online payment system to reduce the payment risk and ensure timely payments to farmers, cleaning, sorting, grading and weighing facilities and additional services such as soil testing laboratories at the e-NAM.

Table 1: State wise list of *Mandis* selected for e-NAM study

S. No.	State	Selected Mandis
1 2	Gujarat	Jetalpur Petlad
3 4 5	Haryana	Samalkha Sirsa and Ellenabad Ganaur
6 7 8 9 10	Madhya Pradesh	Damoh Dabra Jabalpur Patan Rewa
11 12 13	Maharashtra	Malegaon Yeola Shirur
14 15 16 17 18 19	Uttar Pradesh	Agra Aligarh Mundera Bareilly Hardoi Mundera
20 21	Telangana	Nizamabad Mahabubnagar

Note: In Haryana, a combined sample of 50 farmers is taken from Sirsa (17) and Ellenabad (33) mandis

Map 1: Progress of nation-wide coverage of *mandis* under e-NAM



1.4. Objectives of the study: The main aim of the study was to study the extent of realization of the expected benefits of e-NAM. The scheme has been rolled out in about 13 states so far and it is important to assess the extent of realization of these benefits. As of 17 July 2017, 455 markets across 13 states have been integrated with e-NAM (Table 1 and Map 1). The present study aimed to study the functioning of few of these e-NAMs in the country. The specific objectives of the study are to

1. Study the extent of operation, adoption and functioning of e-NAM in some of the major markets;
2. Analyze the improvements due to e-NAMs in price discovery, quantity traded and marketing cost, among other things;
3. Assess the functioning of the assaying laboratories at the e-NAMs and acceptability of quality parameters to various stakeholders;
4. Analyze the infrastructure facilities at the e-NAMs for cleaning, sorting, grading and weighing of commodities; and
5. Assess the overall impact on the ease of doing business

1.5. Data and Methods: The study employed both secondary and primary data. The secondary data on prices, market arrivals and bids / offers collected by various e-NAM mandis available with the Department of Marketing, MoA&FW, GoI are used to analyze the market trends before and after the introduction of e-NAM. At present, 455 markets have been

integrated with e-NAM across 13 states. Of these, majority of the markets (341) are located in six states (UP-100, MP-58, Haryana-54, Maharashtra-45, Telangana-44 and Gujarat-40). Therefore, this study has focused on these states and collected primary data from about 5% of these 341 markets – in about 17 markets. The Agro-Economic Research Centres of the respective states conducted the primary data collection and analysis. The detailed list of selected mandis is provided in the Table 1. Each AERC has visited the mandis selected and made a list of farmers and traders/Commission Agents registered at the mandi/market. Then a sample of 100 farmers, 25 traders and 25 commission agents selected randomly for survey. The structured questionnaire used for data collection. The data was collected pertain to the major commodities traded in these markets, while focusing on grains and fruits & vegetables.

Analytical tools: The study used simple descriptive statistics for much of the analysis. However, variations in prices are calculated using the following formula:

Taken difference of natural log of monthly prices, i.e. between month t and month t-1

$$D(P_t) = LN(P_t) - LN(P_{t-1}) \dots \dots \dots (1)$$

Standard Deviation of this difference for a particular period, i.e. period 1 and period 2.

$$STDEV[D(P_t)] = Stndrd Devition of difference D(P_t) for perticulr period \dots (2)$$

The determinants of satisfaction with selling in eNAM has been analyzed using a logit model as specified below:

$$Y = \frac{1}{1+e^{-z}} \dots \dots \dots 1 \dots \dots (2)$$

where the dummy dependent variable Y represents whether farmers are satisfied with eNAM, and on the right hand side, Z is the linear combination of the explanatory variables $X_1, X_2, X_3, \dots, X_k$; $Z = a + b_1X_1 + b_2X_2 + \dots + b_kX_k$; and a, b_1, b_2, \dots, b_k are the coefficients. The independents variables included those related to socio economic and demographic characteristics of the households such as, education, farm size, of the head of the household, ; as well as those pertaining to crop, irrigation, and regional location; and several dummy variables related to improving market price discovery and reducing transaction costs like assaying facility, e-auction facility, quality testing parameters and so on.

The price differential for a participant farm household in eNAM can be either higher or lower and cannot be known *a priori*. However, there are limitations of available models to include observations with negative values. Tobit model can solve this problem by allowing dependent variable with both positive and null values. In this situation, Tobit models specified below

has been used to analyse the determinants of price realisation in electronic markets as the dependent variable (price differential compared to pre-eNAM scenario) consisted of both zero and positive values. The structural equation in the Tobit model is:

$$y_i^* = X_i\beta + \varepsilon_i \dots \dots \dots (3)$$

where $\varepsilon_i \sim N(0; \sigma^2)$. y^* is a latent variable that is observed for values greater than τ and censored otherwise. The observed y is defined by the following measurement equation:

$$y_i = \begin{cases} y^* & \text{if } y^* > \tau \\ T_y & \text{if } y^* \leq \tau \end{cases} \dots \dots \dots (4)$$

In the typical Tobit model, we assume that $\tau = 0$ i.e. the data are censored at 0. Thus, we have

$$y_i = \begin{cases} y^* & \text{if } y^* > 0 \\ 0 & \text{if } y^* \leq 0 \end{cases} \dots \dots \dots (5)$$

Where y_i denotes price differential in percentage over the pre-eNAM price, which is censored at 0. x_i is a vector of independents variables included those related to socio economic and demographic characteristics of the households such as, education, farm size, of the head of the household; as well as those pertaining to crop, irrigation, and regional location; and several dummy variables related to improving market price discovery and reducing transaction costs like assaying facility, e-auction facility, quality testing parameters and so on, which is censored at 0; X_i is a matrix of explanatory variables that are hypothesised to influence irrigation water use (productivity) either positively or negatively. β represents vector of unknown parameters to be estimated corresponding to the matrix of explanatory variables. The disturbance term ε_i is assumed to be normally distributed with mean '0' and variance σ^2 .

1.6. Organization of the study: The study is planned into five sections. Introduction with background, objectives and methodology of the study are presented in Section 1. Problems in agricultural marketing and evolution of eNAM is reviewed in in Section 2. Analysis of price trends in pre and post-eNAM adoption scenarios are brought out with secondary data in section 3. Price volatility in the selected crops across states over the study period is analysed in Section 4. The section 5 describes performance of e-NAM based on surveyed data. The last section concludes with major findings and policy recommendations.

2. Problems in Agricultural Marketing and Evolution of eNAM

There are many studies on reforms in agricultural marketing, doubling farmer's income, impact of e-market in Karnataka and how the e-NAM would impact on stakeholders. However, no studies are documented analyzing performance and prospects of Electronic National Agricultural Market (e-NAM). Some relevant literature connection to electronic national agricultural marketing is quoted in the study.

2.1. Background of agricultural marketing reforms: After the Independence, there was a need of reforms in agricultural marketing. Therefore, the Agricultural Produce Marketing (Regulation) Act (APMRA) was implemented during 1960s and 1970s across states in India. The APMRA has brought major achievements in the Green Revolution and made self-reliant in terms of food grains production (Acharya et al., 2012). Though APMRA has brought drastic changes and significant improvement in almost all aspects of marketing of farm produce, due to some of the major problems like inadequate infrastructure, limited access to markets and presence of middle man, the reform of agricultural markets has been crucial issues in India for some decades (Chand, 2012). In 2003, the agricultural market reform was initiated first time by union government with the introduction of Agricultural Produce Marketing Committee (APMC) Act 2003. Thereafter many agricultural market reforms emerged such as warehouse receipts Act, 2006 and Food Safety and standards Act in 2006. These market reforms have brought new changes to the agricultural market, however, with the time variation, they have not touched the issues of poor competitiveness, fragmentation of land, inefficiency, presence of excessive middlemen, inequality in farmers' price and frequent price manipulations which are core characteristics of agricultural markets in India (Chand, 2016). Realizing this, Ministry of Agriculture and Farmers' Welfare (MoAFW) come up with a model called electronic trading portal for national agricultural market (e-NAM) for transforming the system of agricultural marketing.

2.2. E-market system in Karnataka: The e-NAM was introduced being impressed by the achievement of the e-trading system in the selected regulated agricultural markets of the state Karnataka which was the first one among the states across India in implementing the model APMC Act through Rashtriya e-Market Services (ReMS), with the support of NCDEX (National Commodity and Derivatives Exchange) Spot Exchange. Though the e-trading was practiced in APMC markets of Karnataka since the year 2006, the e-market started in the state in the year 2011 and has covered 155 APMC markets by the year 2016. The objective of

the plan was to integrate all such markets (mandis) coming under APMCs to fetch remunerative and transparent prices to farmers, facilities for grading, automated auction, post-auction facilities, assaying facilities in the markets, facilitation of warehouse-based sale of produce, commodity funding, price dissemination and standardization to facilitate seamless trading across mandis on the portal of ReMS (Chand, 2016a). The e-market system in Karnataka has not only increased farm income but also shown positive impact on arrivals, prices and has helped in scientific discovery of prices. The system has been effective in enhancing the trade competitiveness by integrating different markets across the state. The system also has the potential of integrating with concepts like warehousing, grading, electronic payment, electronic weighment, packaging, branding and pledge financing and achieved the basic objective of a Single Integrated Market (Chengappa et al., 2012; Shalendra, 2013). Athawale (2014) in his study stated that the introduction of e-trading system in the selected regulated agricultural markets of Karnataka has improved the marketing efficiency through competitive and transparent bidding mechanism, and by minimization of manipulations in trading practices.

Reddy (2016) analysed 16 e-markets and 16 non-e-markets (e-mandis) in Karnataka using difference-in-difference approach to understand the impact of e-market on farmers, traders, commission agents and market committee and come to know the increased competition among traders, reduced scope for collusion, increased number of bids per lot from about six to eleven. There was also 128 percent of increase in average prices in e-markets compared to only 88 percent in non-e-markets between 2007 and 2015. And also there was significant reduction in price variability in e-markets compared to increase in non-e-markets. The difference-in-difference regression resulted that with the introduction of e-markets, prices increased by Rs.65/q after controlling for initial conditions. There was also an increase in average market arrivals by 1166 tons with the introduction of e-markets. All stakeholders mentioned that there was increased transparency and reduced delay in payment. The positive impact of e-market in Karnataka on farmers as well as on traders was documented in various studies (Chand, 2016; Reddy, 2016).

According to the government's think tank NITI Ayog report farmers in Karnataka have realised 38 per cent of income in nominal terms and 13 percent of income in real terms in the year 2015-16 from the sale of agricultural commodities through the e-trading interface Unified Market Platform (UMP) (GoI, 2017). Agarwal et al. (2017) attempted the qualitative

survey across various mandis in the Karnataka, and stated that Rashtriya electronic Market Scheme (ReMS) has helped farmers in Karnataka generating higher revenues, increasing the number of bids, increasing competition among traders and reducing scope for collusion.

2.3. Electronic National Agricultural Market (e-NAM): Impressed by the success story of the of the e-market in the Karnataka, the Government of India, introduce the electronic trading platform at national level called National Agricultural Market (e-NAM) on 14th April 2016 with a objective of one price in one market in one nation. According to the Economic Survey 2014-15, a total of 2477 principal regulated primary agricultural markets are active in India. Of which e-NAM started with 21 Mandis across 8 States and trading of 24 Commodities. The number of markets integrating in e-NAM increased to 470 mandis across 14 states and trading of 90 commodities (as of 31st Oct 2017). At present the number of mandis integrated in e-NAM is 479 across 14 states in India (<https://www.e-NAM.gov.in/e-NAM/mandis>).

The broad aim of the e-NAM is to create transparent sale transactions, price discovery, liberalizing licensing of traders or buyers and commission agents, reduce price variations, facilitate a single license to traders, removing middle man, reducing transaction cost, harmonization of quality standards of agricultural produce and provision for assaying, common tradable parameters and single point levy of market fees and ultimately doubling the farmers' income (Chand, 2016; Dey, 2016, Reddy, 2016, Sekhar and Bhatt, 2018).

Keeping in view the aims of e-NAM, Sekhar and Bhatt, (2018) attempted to evaluate the status, performance and prospects of Electronic National Agricultural Market (e-NAM) as well as problems and constraints at e-NAM and stakeholders' perspective on e-NAM in Haryana using both secondary and primary data. The result of the study showed positive impact of e-NAM on farmers in terms of higher price realization, convenience in online payment, better facilities for knowing quality of product, less complicated and transparent in sale process. This result is consistent with the achievement of the e-market in the state Karnataka as well as the purpose of introduction of e-NAM. However, in order to understand the overall impacts of e-NAM on farmers and traders across six states in India, this study has been carried out using both primary and secondary data before and after the introduction of e-NAM. Simple statistical tools have been used in the study.

3. Trends in prices of select crops across states: Business as usual scenario

As mentioned in the previous chapter, only six states were surveyed for e-NAM to examine the performance of e-NAM and its impacts on farmers' price and income, traders' benefit and reduction in consumers' price. Before we analyse the survey data, secondary data on price for different crops have been analysed, in this chapter, for primary understanding of price differences in crops across the sampled states.

3.2. Landscape of study area: Since the study is based on six sample states, it is essential to study the characteristics of these states. Basically there are number of essential characteristics of a state, however, in this study, number of mandis under e-NAM and Distribution of land holdings across farmer class in selected states and distribution of land holdings across farmer class in selected states are described.

Table 2 shows *mandis* under e-NAM and sample *mandis* selected for survey in six states. In the state Gujarat, two out of 40 *mandis* were surveyed. Similarly in Haryana 3 out of 54, in Madhya Pradesh 5 out of 58, in Maharashtra 3 out of 45, in Telangana 2 out of 44 and in Uttar Pradesh 6 out of 100 *mandis* were selected for survey. Over all 21 *mandis* out of 241 were selected for survey across selected states.

Table 2: List of *mandis* under the covered states and selected sampled *mandis*

state	<i>Mandis</i> under e-NAM	Sampled <i>Mandis</i>
Gujarat	40	2
Haryana	54	3
Madhya Pradesh	58	5
Maharashtra	45	3
Telangana	44	2
Uttar Pradesh	100	6
Overall	241	21

Source: eNAM website

Table 3: Distribution of land holdings across farmer class in selected states

Size group (in Hectare)	Gujarat	Haryana	MP	Mahara shtra	Telan gana	UP	Overall
Marginal (Below 1.0)	37.93	49.29	48.33	40.12	64.56	80.18	68.52
Small (1.0 - 1.99)	30.37	19.29	27.24	21.91	23.69	12.63	17.69
Semi Medium (2.0 - 3.99)	21.62	17.07	16.74	18.5	9.48	5.51	9.45
Medium (4.0 - 9.99)	9.32	11.81	7.07	14.78	2.11	1.58	3.76
Large (10 and above)	0.75	2.54	0.63	4.69	0.16	0.1	0.57

Source: Key Inputs Survey of DES

State wise size of landholdings among farmers is presented in Table 3. According to the size of landholdings, marginal farmers are highest in Uttar Pradesh (80.18%) followed by Telangana (65%), Haryana (49%), Madhya Pradesh (48%). Overall, while around 69 per cent

of marginal farmers, only less than 1 per cent of large farmers are noticed across selected states.

3.2. State-wise crop price variations across sampled states: Agriculture is the most important sector of Indian Economy. India follows diversifying and multiple cropping system from cash crops to non-cash crops across states. In this study the price differences in few major crops which are majorly cultivated in the sampled states are discussed. Table 4 presents price differences in crops in the state Gujarat during 2015-17 and 2017-18. The result showed that except the crop Jowar, price for all the crops given in the table have declined during the period. This decline is extreme in Tur (44%) followed by all pulses (43%) and moong (42%). This result is positively corroborated with the result of the recent study by Sekhar and Batt (2018). Though it gives a thought that farmers from Gujarat have received fewer profits during the period, it happened due to the seasonal variation which makes farmers to receive higher price in the Jowar but not in other crops.

Table 4: Crop Price differences in pre-eNAM and post-eNAM periods in Gujarat

Crop	Apr 2015 to Oct 2017	Nov 2017 to Mar 2018	Absolute Diff	% Diff
Paddy	1640.7	1498.7	-142.1	-8.7
Wheat	2057.0	1696.2	-360.7	-17.5
All pulses	7158.2	4076.6	-3081.6	-43.0
Moong	7732.4	4429.6	-3302.8	-42.7
Tur	6645.6	3723.6	-2922.0	-44.0
Bajra	1704.9	1251.1	-453.8	-26.6
Groundnut	4872.4	3588.7	-1283.8	-26.3
Jowar	2206.1	2435.3	229.2	10.4
Maize	1627.1	1373.1	-254.0	-15.6
all available crops	3550.2	2600.2	-950.0	-26.8

In case of Haryana (Table 5), farmers get higher price for almost all crops during 2015-17 and 2017-18. Farmers have sold their paddy in the year 2017-18 at 47 per cent higher than the year 2015-17 which shows highest profits received by the farmers. Around 22 per cent of differences is noticed when farmers sell pulses and moong in 2017-18. This has taken place due to the arrivals of large quantity of paddy during the rabi season during which price for the crop was also higher than the kharif season. Though the farmers have received profits from cotton, maize and groundnut by selling during November, 2017 to March, 2018, the magnitude of profit is comparatively low ranges 2-4 per cent. The negative price differences in the crop Bajra, both in absolute and percentage term shows that farmers have not earned profits due to declining price for the same crop during the same period.

Table 5: Crop Price differences in pre-eNAM and post-eNAM periods in Haryana

Crop	Apr 2015 to Oct 2017	Nov 2017 to Mar 2018	Absolute Diff	% Diff
Paddy	2160.7	3177.2	1016.6	47.0
Wheat	1537.8	1717.8	180.0	11.7
All pulses	4221.1	5135.3	914.3	21.7
Moong	4221.1	5135.3	914.3	21.7
Bajra	1345.9	1179.6	-166.3	-12.4
Cotton	4837.7	4938.2	100.5	2.1
Groundnut	3667.9	3828.7	160.8	4.4
Maize	1242.5	1273.0	30.5	2.5
all available crops	3471.8	3184.0	-287.7	-8.3

Table 6: Crop Price differences in pre-eNAM and post-eNAM periods in Madhya Pradesh

Crop	Apr 2015 to Oct 2017	Nov 2017 to Mar 2018	Absolute Diff	% Diff
Paddy	1657.5	1880.8	223.3	13.5
Wheat	1748.9	1652.4	-96.5	-5.5
All pulses	5127.1	3439.3	-1687.8	-32.9
Gram	5789.9	3624.3	-2165.6	-37.4
Gram Dal	5068.9	3641.9	-1427.0	-28.2
Masur	4730.9	3087.6	-1643.3	-34.7
Masur Dal	2926.6	2895.7	-30.9	-1.1
Moong	4962.8	3765.4	-1197.4	-24.1
Moong Dal	3597.0	3773.0	176.0	4.9
Tur	5111.3	3477.1	-1634.2	-32.0
Bajra	1310.7	1061.7	-249.1	-19.0
Groundnut	4089.1	3481.5	-607.6	-14.9
Jowar	1509.9	1540.6	30.7	2.0
Maize	1374.1	1102.0	-272.1	-19.8
all available crops	3431.4	2811.9	-619.5	-18.1

The crop price differences in crops scenario in Madhya Pradesh is something different from Gujarat and Haryana during the period (2015-17 to 2017-2018). Farmers have received 14, 5 and 2 per cent higher price only in paddy, moong dal and jowar respectively. However, they have not received profits from all other crops mentioned in Table 3 during the same period. Price for the crops have declined in big way in gram (37%), masur (34%), all pulses (33%) and tur (32%). The similar price declining situation can be observed by the other crops too. The reason behind the declining of the price for the crop is that most of the crops are kharif crops and sold during rabi crop season (Table 6).

Table 7: Crop Price differences in pre-eNAM and post-eNAM periods in Maharashtra

Crop	Apr 2015 to Oct 2017	Nov 2017 to Mar 2018	Absolute Diff	% Diff
Wheat	1878.5	1758.5	-120.0	-6.4
All pulses	3800.7	3921.2	120.5	3.2
Gram	6118.7	3678.2	-2440.5	-39.9
Moong	5661.6	4330.5	-1331.0	-23.5
Tur	6590.7	3912.6	-2678.1	-40.6
Bajra	1748.1	1281.9	-466.2	-26.7
Cotton	4948.8	4614.6	-334.2	-6.8
Jowar	1745.8	1530.3	-215.5	-12.3
Maize	1459.5	1128.9	-330.5	-22.6
all available crops	3645.6	2913.4	-732.2	-20.1

Table 7 shows the crop price differences in the state Maharashtra. Price for the crops like wheat, gram, moong, tur, Bajra, Cotton, Jowar and Maize has been declined during the years 2015-17 and 2017-18. This shows that farmers from Maharashtra have not received profits or remunerative prices for the above commodities over the time period. The highest decline in price have been observed in tur (41%) followed by gram (40%), bajra (27%), moong (24%) and maize (23%). However, they have received profits in only pulses and that is only three percentages higher as compared to 2015-17.

Table 8: Crop Price differences in in pre-eNAM and post-eNAM periods Telangana

Crop	Apr 2015 to Oct 2017	Nov 2017 to Mar 2018	Absolute Diff	% Diff
Paddy	1463.8	1585.3	121.5	8.3
All pulses	5050.0	4326.4	-723.6	-14.3
Tur	5050.0	4326.4	-723.6	-14.3
Cotton	4493.7	4380.9	-112.8	-2.5
Jowar	1288.2	1975.2	687.1	53.3
all available crops	1463.8	1585.3	121.5	8.3

Table 8 shows that farmers from Telangana have gained profit by selling paddy and all available crops but not in pulses, tur, cotton and jowar over the period 2015-17 and 2017-18. They have received 53 per cent higher price by selling it in 2017-18. For pulses and tur, the absolute price difference around Rs. -724 which is 14 per cent. This implies farmers are better off in 2015-17 than 2017-18.

Table 9: Crop Price differences in in pre-eNAM and post-eNAM periods Uttar Pradesh

Crop	Apr 2015 to Oct 2017	Nov 2017 to Mar 2018	Absolute Diff	% Diff
Paddy	1410.0	1801.9	391.9	27.8
Wheat	1634.9	1607.3	-27.6	-1.7
All pulses	7220.9	5211.2	-2009.7	-27.8
Gram	6233.1	5291.0	-942.1	-15.1
Gram Dal	8437.5	5979.7	-2457.8	-29.1
Masur	5890.1	3850.5	-2039.6	-34.6
Masur Dal	6847.5	5482.5	-1365.0	-19.9
Moong	6769.4	4910.7	-1858.8	-27.5
Moong Dal	7097.7	5982.0	-1115.7	-15.7
Tur	6828.5	4160.3	-2668.2	-39.1
Bajra	1251.5	1083.3	-168.2	-13.4
Groundnut	5681.9	4499.5	-1182.4	-20.8
Maize	1478.9	1273.4	-205.5	-13.9
all available crops	4961.6	3984.9	-976.7	-19.7

The state Uttar Pradesh has more numbers of mandis and most of them have been coming under e-NAM. Farmers have participated in selling their crops in these mandis. Table 9 shows whether farmers have received any positive price differences by selling their crops over the time period? The positive price differences are noticed in only paddy (27%). This shows that price for paddy

Table 10: Price differences in cereals in pre-eNAM and post-eNAM periods across sample states

States	Apr 2015 to Oct 2017	Nov 2017 to Mar 2018	Absolute Diff	% Diff
Paddy and wheat				
Gujarat	1848.8	1597.4	-251.4	-13.6
Haryana	1916.6	2800.5	883.9	46.1
Madhya Pradesh	1703.2	1766.6	63.4	3.7
Maharashtra	1878.5	1758.5	-120.0	-6.4
Telangana	1463.8	1585.3	121.5	8.3
Uttar Pradesh	1522.4	1704.6	182.2	12.0
Paddy				
Gujarat	1640.7	1498.7	-142.1	-8.7
Haryana	2160.7	3177.2	1016.6	47.0
Madhya Pradesh	1657.5	1880.8	223.3	13.5
Telangana	1463.8	1585.3	121.5	8.3
Uttar Pradesh	1410.0	1801.9	391.9	27.8
Wheat				
Gujarat	2057.0	1696.2	-360.7	-17.5
Haryana	1537.8	1717.8	180.0	11.7
Madhya Pradesh	1748.9	1652.4	-96.5	-5.5
Maharashtra	1878.5	1758.5	-120.0	-6.4
Uttar Pradesh	1634.9	1607.3	-27.6	-1.7
Bajra				
Gujarat	1704.9	1251.1	-453.8	-26.6
Haryana	1345.9	1179.6	-166.3	-12.4
Madhya Pradesh	1310.7	1061.7	-249.1	-19.0
Maharashtra	1748.1	1281.9	-466.2	-26.7
Uttar Pradesh	1251.5	1083.3	-168.2	-13.4
Jowar				
Gujarat	2206.1	2435.3	229.2	10.4
Madhya Pradesh	1509.9	1540.6	30.7	2.0
Maharashtra	1745.8	1530.3	-215.5	-12.3
Telangana	1288.2	1975.2	687.1	53.3
Maize				
Gujarat	1627.1	1373.1	-254.0	-15.6
Haryana	1242.5	1273.0	30.5	2.5
Madhya Pradesh	1374.1	1102.0	-272.1	-19.8
Maharashtra	1459.5	1128.9	-330.5	-22.6
Uttar Pradesh	1478.9	1273.4	-205.5	-13.9

have increased from the year 2015-17 to 2017-18 and farmers have received profit. Apart from paddy, there is no positive price difference in almost all the crops, implying that farmers have not gained comparative price by selling in 2017-18. The highest negative price differences are seen tur (39%), followed by masur (35%), 27 per cent in pulses and moong. The lowest negative price differences are observed in wheat. This may be due to more arrivals of wheat (Table 9).

Table 11: Price differences in Pulses in pre-eNAM and post-eNAM periods across sample states

Price differences: Gram				
States	Apr 2015 to Oct 2017	Nov 2017 to Mar 2018	Absolute Diff	% Diff
Gram				
Madhya Pradesh	5789.9	3624.3	-2165.6	-37.4
Maharashtra	6118.7	3678.2	-2440.5	-39.9
Uttar Pradesh	6233.1	5291.0	-942.1	-15.1
Gram Dal				
Madhya Pradesh	5068.9	3641.9	-1427.0	-28.2
Uttar Pradesh	8437.5	5979.7	-2457.8	-29.1
Arhar				
Gujarat	6645.6	3723.6	-2922.0	-44.0
Madhya Pradesh	5111.3	3477.1	-1634.2	-32.0
Maharashtra	6590.7	3912.6	-2678.1	-40.6
Telangana	5050.0	4326.4	-723.6	-14.3
Uttar Pradesh	6828.5	4160.3	-2668.2	-39.1
Moong				
Gujarat	7732.4	4429.6	-3302.8	-42.7
Haryana	4221.1	5135.3	914.3	21.7
Madhya Pradesh	4962.8	3765.4	-1197.4	-24.1
Maharashtra	5661.6	4330.5	-1331.0	-23.5
Uttar Pradesh	6769.4	4910.7	-1858.8	-27.5
Moong Dal				
Madhya Pradesh	3597.0	3773.0	176.0	4.9
Uttar Pradesh	7097.7	5982.0	-1115.7	-15.7
Masur				
Madhya Pradesh	4730.9	3087.6	-1643.3	-34.7
Uttar Pradesh	5890.1	3850.5	-2039.6	-34.6
Masur Dal				
Madhya Pradesh	2926.6	2895.7	-30.9	-1.1
Uttar Pradesh	6847.5	5482.5	-1365.0	-19.9
Pulses				
Gujarat	7158.2	4076.6	-3081.6	-43.0
Haryana	4221.1	5135.3	914.3	21.7
Madhya Pradesh	5127.1	3439.3	-1687.8	-32.9
Maharashtra	3800.7	3921.2	120.5	3.2
Telangana	5050.0	4326.4	-723.6	-14.3
Uttar Pradesh	7220.9	5211.2	-2009.7	-27.8

Price differences in cereal crop during the periods 2015-17 to 2017-18 is shown in Table 10. While the farmers from Haryana, Madhya Pradesh, Telangana and Uttar Pradesh getting profits by selling both paddy and wheat in 2017-18, farmers from Gujarat and Maharashtra shown negative return. But farmers from all the selected states, except Gujarat, have positive return by selling paddy and have negative return in wheat and Maize (except Haryana). Though farmers from Gujarat, Madhya Pradesh and Telangana have profit in jowar but they have negative return in Bajra.

Table 11 shows the price differences in pulses across sample states. While farmers from Gujarat, Haryana, Madhya Pradesh, Maharashtra, Telangana and Uttar Pradesh show negative price difference, implying they have not received profit in Gram, Gram Dal, Tur, Moong, Moong Dal, Masur and even all the pulses, only three states Haryana (in Moong), Madhya Pradesh (in Moong Dal) and Haryana and Maharashtra (in all pulses) have shown positive return during the time period.

Table 12: Price differences in groundnut and cotton in pre-eNAM and post-eNAM periods

States	Apr 2015 to Oct 2017	Nov 2017 to Mar 2018	Absolute Diff	% Diff
Groundnut				
Gujarat	4872.4	3588.7	-1283.8	-26.3
Haryana	3667.9	3828.7	160.8	4.4
Madhya Pradesh	4089.1	3481.5	-607.6	-14.9
Uttar Pradesh	5681.9	4499.5	-1182.4	-20.8
Cotton				
Haryana	4837.7	4938.2	100.5	2.1
Maharashtra	4948.8	4614.6	-334.2	-6.8
Telangana	4493.7	4380.9	-112.8	-2.5

When we look at the price differences in seed plants like groundnut and cotton in Table 12, farmers from the state Haryana have received profit not only in groundnut but also in cotton. However, farmers from other states have shown negative price differences in both groundnut and cotton during the same period. This shows that farmers from other states have not received profits by selling seed plant in 2017-18.

Table 13: Price differences in all crops in pre-eNAM and post-eNAM periods across sample states

States	Apr 2015 to Oct 2017	Nov 2017 to Mar 2018	Absolute Diff	% Diff
Gujarat	3550.2	2600.2	-950.0	-26.8
Haryana	3471.8	3184.0	-287.7	-8.3
Madhya Pradesh	3431.4	2811.9	-619.5	-18.1
Maharashtra	3645.6	2913.4	-732.2	-20.1
Telangana	1463.8	1585.3	121.5	8.3
Uttar Pradesh	4961.6	3984.9	-976.7	-19.7

Table 13 shows price differences of all the crops across states selected during 2015-17 to 2017-18. Except the state Telangana, price for crops have declined across states during 2015-17 to 2017-18. This result is consistent with absolute and percentage difference for all the crops (Table 13). But when we look at price for both paddy and wheat, price for these commodities have increased in the states Haryana, Madhya Pradesh and Telangana during 2015-17 to 2017-18. And price for these commodities have increased steeply in the state

Haryana by 46% (Table 13). However, when we analyse only the price for pulses commodities, price for these commodities has increased only in state Haryana and Maharashtra during the same period.

3.3: Trends in market price in selected states: There are different components in trend. It may be positive or direct trend and negative or indirect trend. It has been documented in various studies about price variation for different crops which has been a drawbacks for farmers have not received their remunerate price for the crop sold. The e-NAM has been implemented to deal these issues. In this study, trend in market price for major crops over the years across states have been analysed.

Figure 1: Trends in market price in selected states in paddy

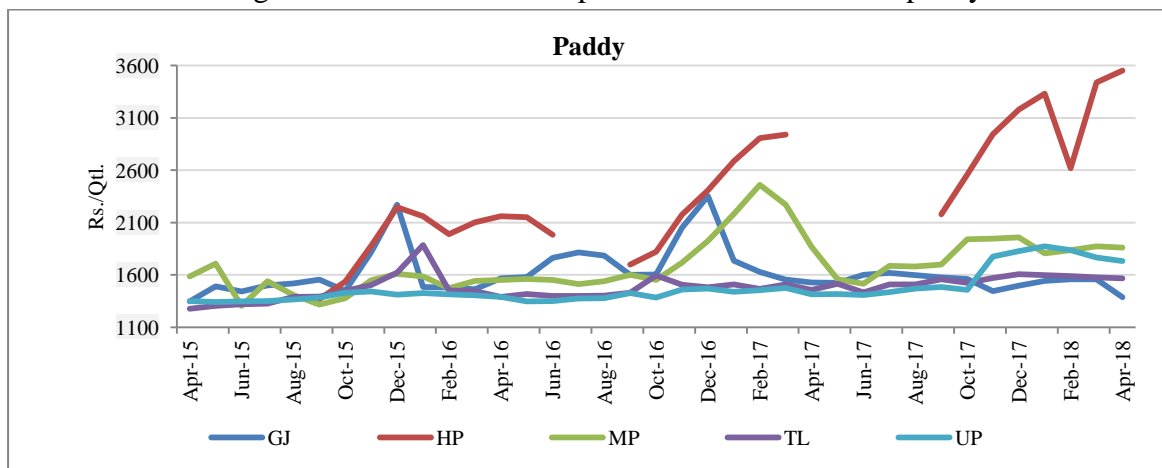


Figure 2: Trends in market price in selected states: Wheat

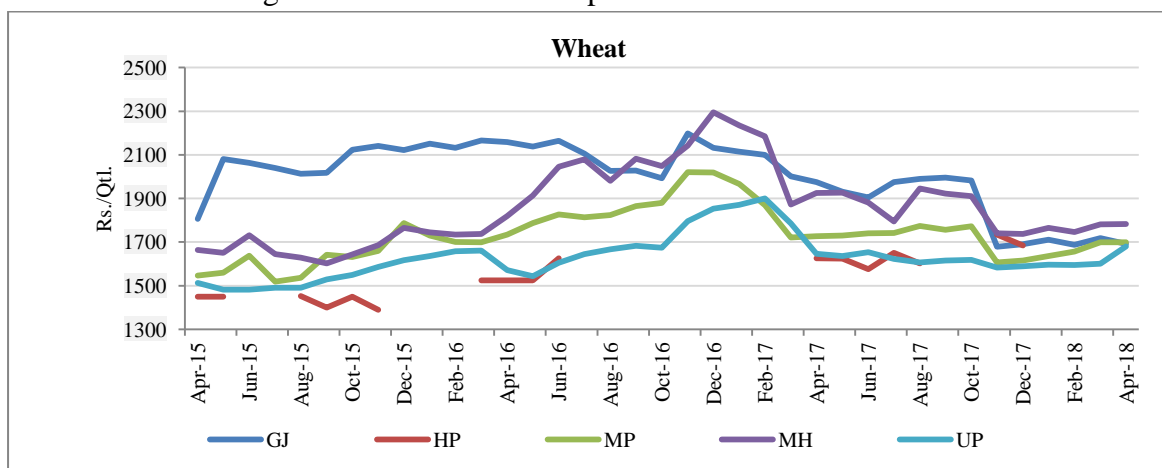


Figure 3: Trends in market price in selected states: Arhar

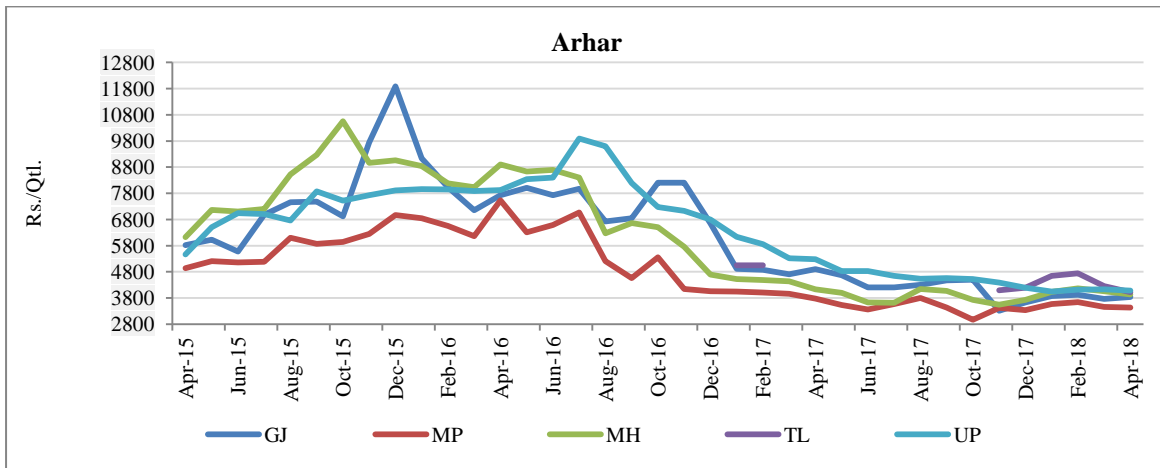


Figure 1 shows market price for paddy in selected states from April 2015 to April 2018. Price has increased in Haryana particularly in the month of October and has started decreasing after February in every year. Trend in market price for paddy in rest of the states given is constant. Though the price for wheat is higher in Gujarat over the time point but overall it has declined after December 2016 (Figure 2). In case of arhar, price declined after December 2015 in all the states (Figure 3). When we look at the trend in market price for gram presented in Figure 4, though it is leading in Uttar Pradesh comparatively, there is a fluctuation of the price over the time period. Another important point is that it has increased up to December 2016 and then declined in rest of the time period.

Figure 4: Trends in market price in selected states: Gram

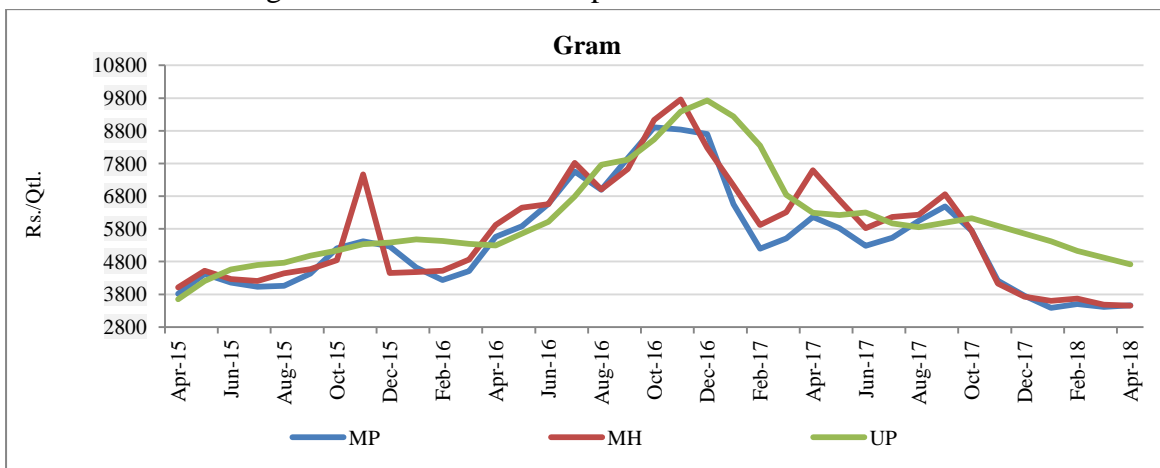


Figure 5: Trends in market price in selected states: Moong

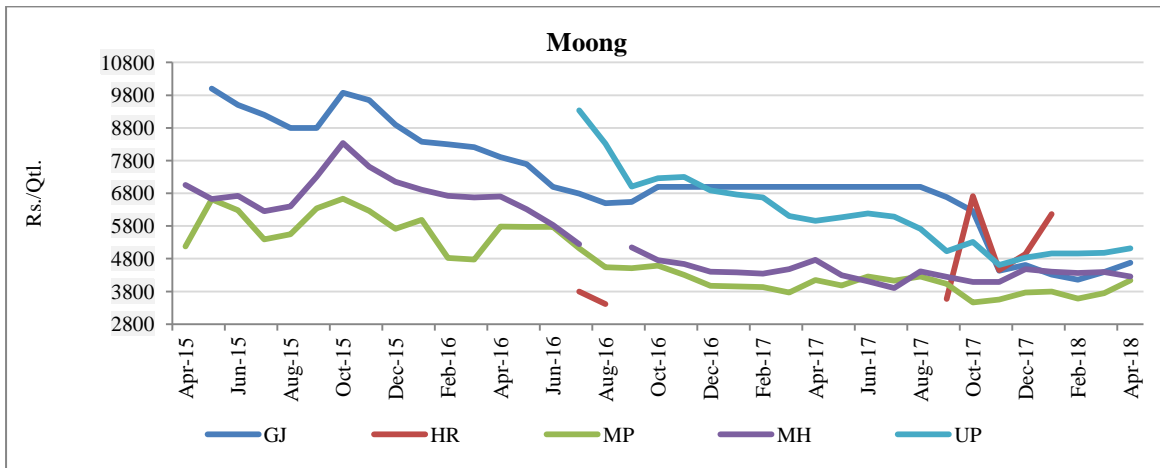


Figure 6: Trends in market price in selected states: Masur

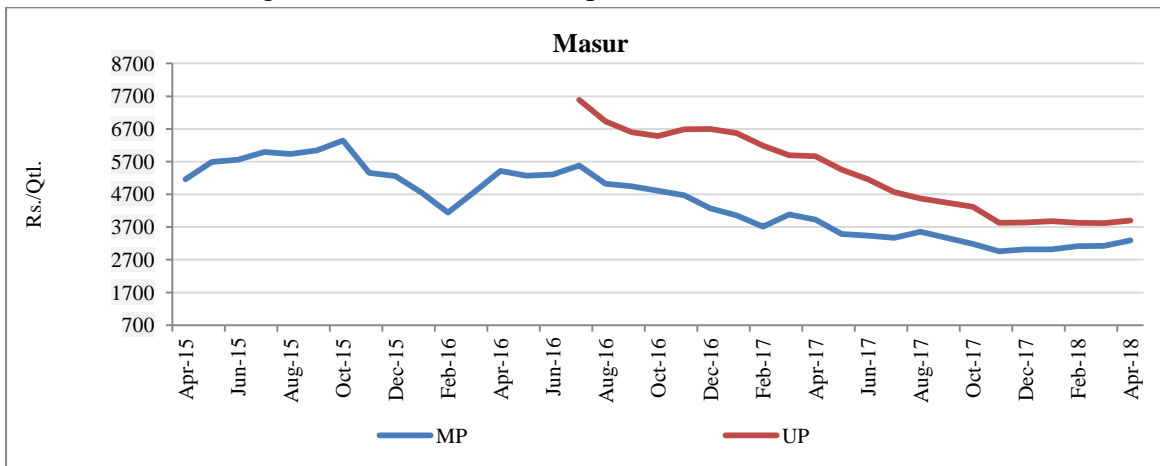
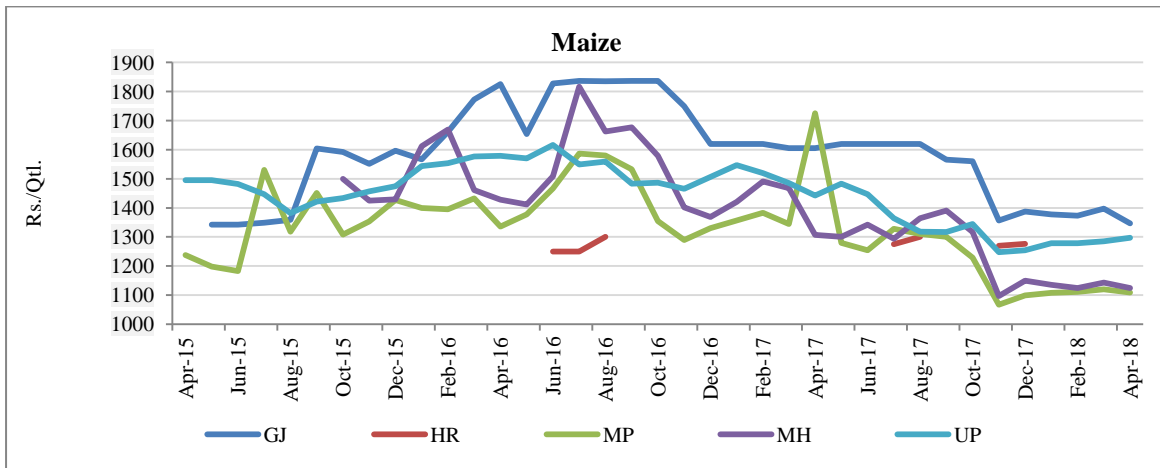


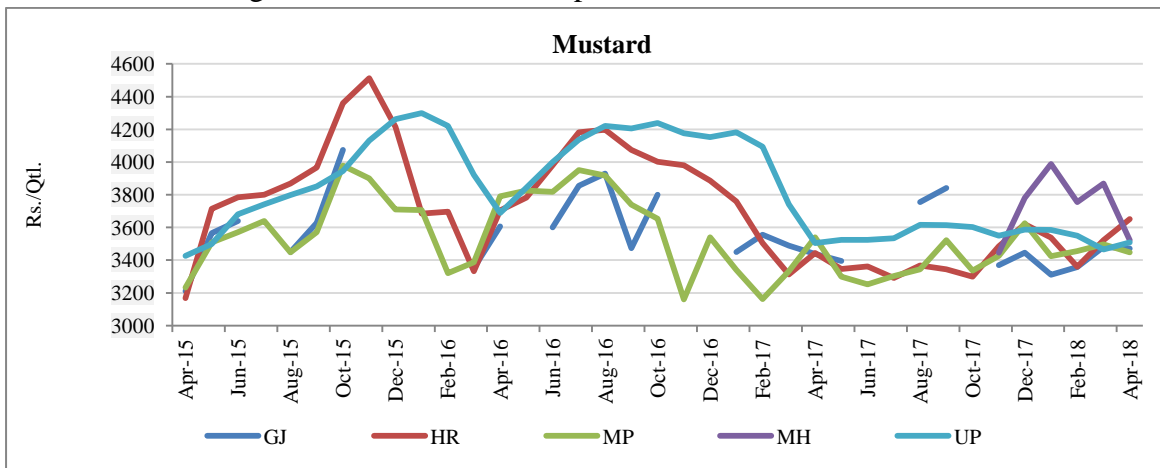
Figure 5 shows the trend in market price for moong in selected states. It has been observed that price for moong is higher in Gujarat as compared to rest of the states, however, it has been declining across the states over the time period taken. The trend in market price for masur shows that, though the price is higher in Uttar Pradesh, it is declining up to December 2017 and constant during rest of the time period (Figure 6). However, market price for maize is something different. The maize price is relatively higher in Gujarat and the least in Madhya Pradesh (Figure 7). The relatively higher prices during April 2016 to October 2016 crashed after October 2017 in the market for maize.

Figure 7: Trends in market price in selected states: Maize



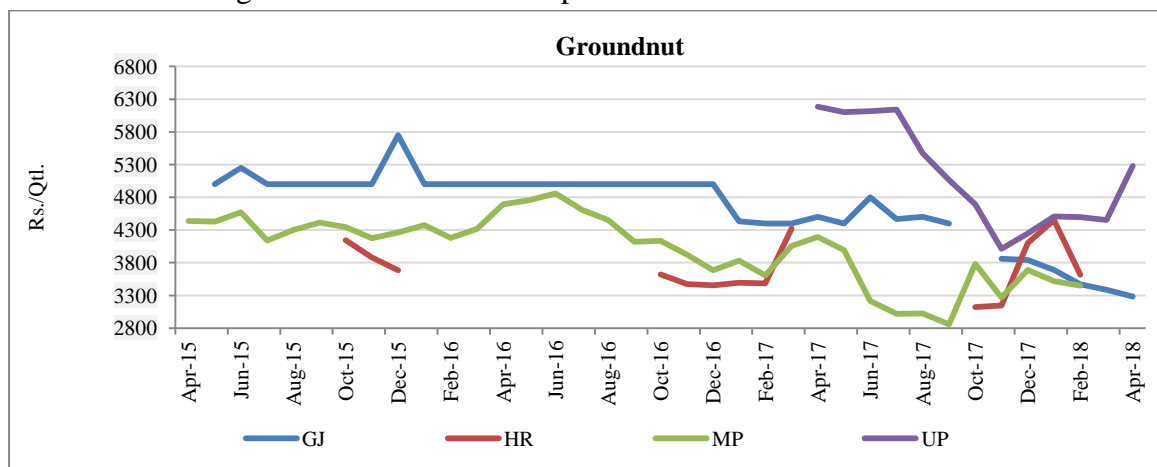
Mustard prices on the other hand have been fluctuating during the study period with peaks around October 2015 and October 2016 (Figure 8). The prices have since collapsed and reached a bottom by June 2017 and started picking up after October 2017. Though they went up from then to reach another peak in February 2018, this peak is much lower than the earlier ones. Among the states, prices in Gujarat have been relatively higher except for a brief period in early 2015 and Haryana closely follows Gujarat.

Figure 8: Trends in market price in selected states: Mustard



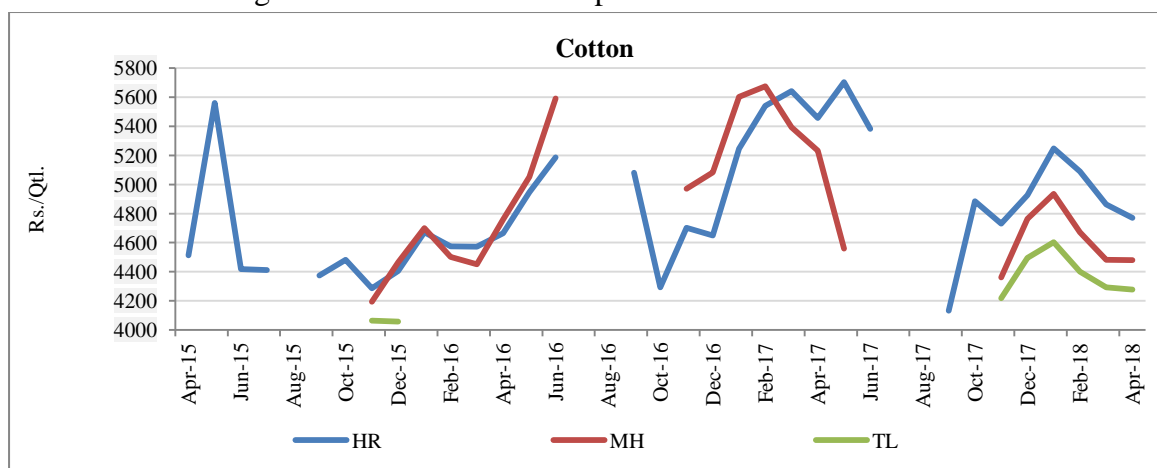
The ground nut prices have been stagnant for much of 2015, reached a trough by October 2017 to pick up slightly from then on (Figure 9). Despite the slight rising trend after October 2017, the prices are much lower than the earlier levels until early 2017. Among the two active oilseed states of Gujarat and MP, the prices in Gujarat are consistently higher than that in in Madhya Pradesh.

Figure 9: Trends in market price in selected states: Groundnut



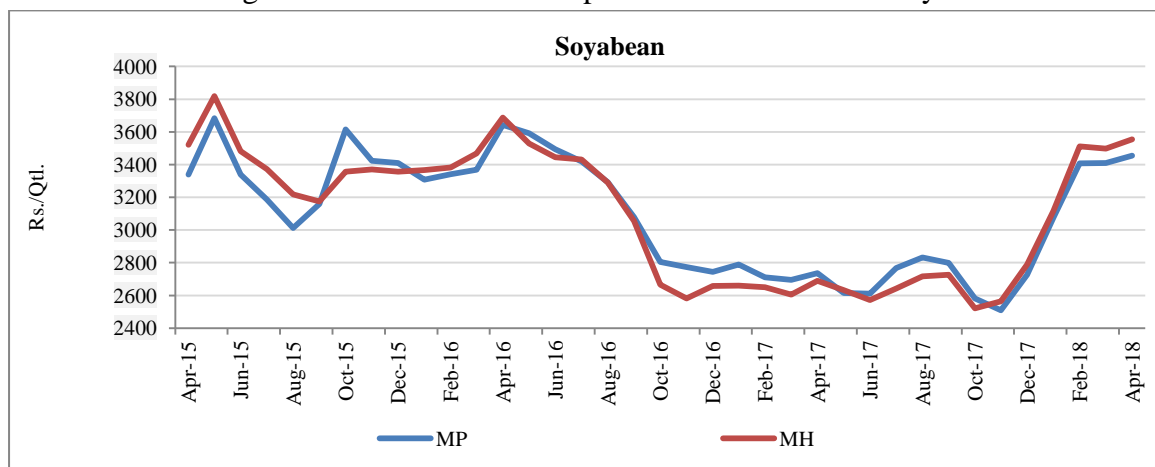
Cotton prices on the other hand exhibited peaks in April and troughs in October when the kapas arrive in the markets (Figure 10). Even then the prices in February 2018 are lower than those peaks. Among the states, prices in Haryana seems to be relatively better.

Figure 10: Trends in market price in selected states: Cotton



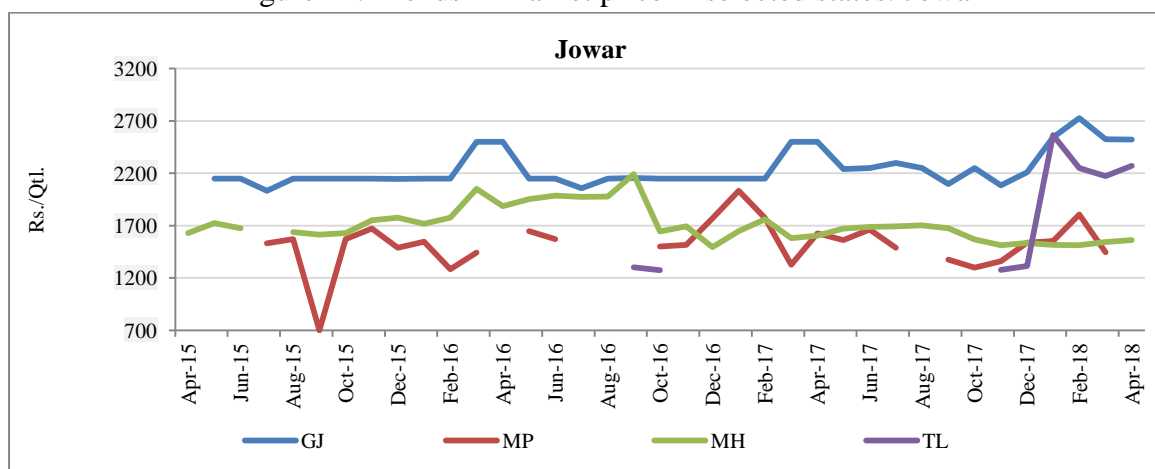
Soybean prices have broadly showed two trends during the study period (Figure 11). They stagnated at around Rs.3500/ quintal during much of 2015 and until April 2016. Then they crashed to as low as Rs.2600/quintal in October 2016 and stagnated at that level till October 2017. They moved up north since then to reach Rs.3400 per quintal in February 2018. During all this period, prices in the two soybean states of MP and Maharashtra are moving in tandem, by and large.

Figure 11: Trends in market price in selected states: Soybean



The prices of jowar have been stagnant during April 2015 to October 2017 and then started raising to reach Rs.2700 per quintal in February 2018 (Figure 12). Among the states, prices in Gujarat are consistently higher followed by that in Maharashtra. The prices of jowar in MP follows similar pattern of lower prices relative to other states for many commodities.

Figure 12: Trends in market price in selected states: Jowar



Based on the secondary data analysis, it is reported that e-NAM has contributed much to the farmers, traders, commission agents and market committee which was expected by many researchers (Reddy, 2016; Sharma and Hussain, 2016; Thakur, 2017). This impact is very much seen the northern region of India. Particularly farmers from north regions have been benefited in terms of prices differences, received higher price for their crops after the implementation of e-NAM. The impact of e-NAM is consistent with the impact of electronic trading of agricultural commodities in Karnataka which documented by many studies earlier (Chand, 2012; Shalendra, 2013; Reddy, 2016). Supplementing to this, the surveyed data is

presented and analysed in the next chapter for in-depth comprehension of the performance and impact of e-NAM on stakeholders particularly on farmers and traders.

4. Market arrivals and price volatility in selected states without eNAM

As discussed earlier, the aim of e-NAM is to discover the farmers' price and achieve transparent price which in turn double the farmers in come. This will succeed when all the produce reach to the markets. The major markets in terms of arrival of different agricultural commodities across the sampled states are also discussed here in the study.

Table 14 shows the market arrival of apple in three states. The highest share of arrival in term of apple is in the markers of Uttar Pradesh (80) and the least share in Maharashtra (5.3) over the years is noticed during the time periods. Figure 13 also shows the similar trend that arrival in Uttar Pradesh is higher than Haryana and Maharashtra in term of apple.

Table 14: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Apple

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Haryana	7590.3	7062.2	4417.9	19070.4	14.9	-7.0	-37.4
Maharashtra	1284.0	3563.0	1951.0	6798.0	5.3	177.5	-45.2
UP	41919.3	37416.6	22481.8	101817.7	79.7	-10.7	-39.9

Figure 13: Trends in market arrival in selected states: Apple

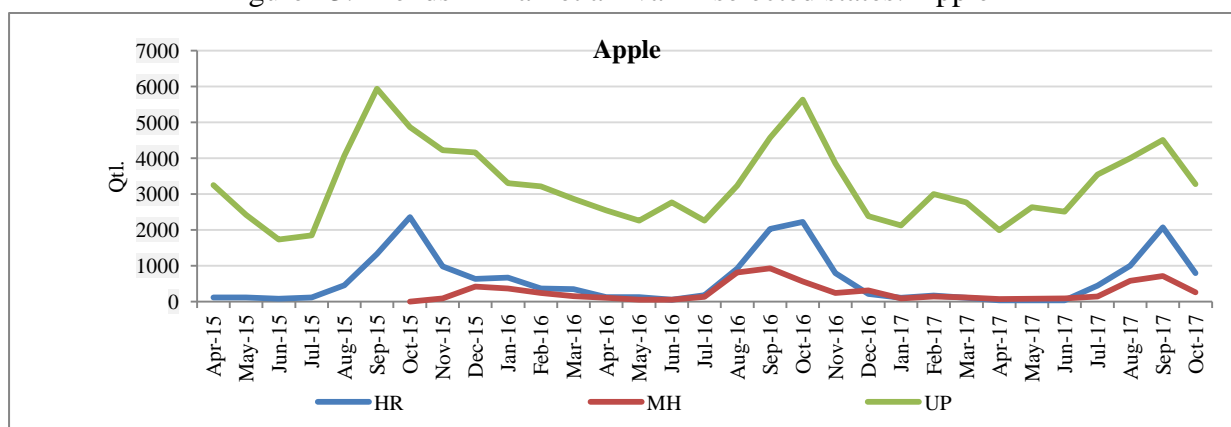


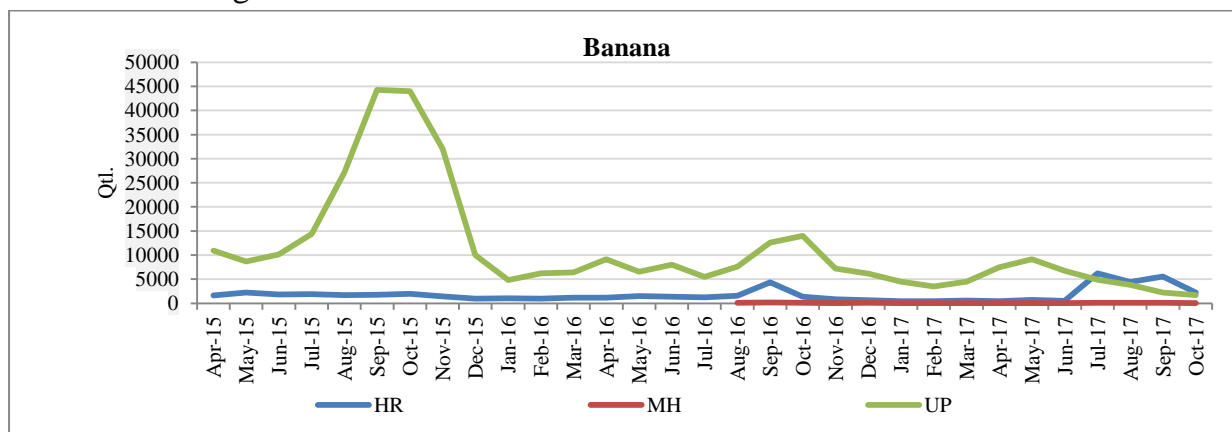
Table 15 shows that Uttar Pradesh is the major market for banana with 86 per cent of arrival, whereas Maharashtra are the least market with only 0.3 per cent of banana arrival. The trend in banana arrival shows that the arrival has taken place mostly during August and October, 2016 and after that it has declined till October, 2017 (Figure 14).

Table 15: Market arrivals in pre-eNAM and post-eNAM periods in the selected states:

Banana

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Haryana	18766.0	15520.7	20035.1	54321.8	13.6	-17.3	29.1
Maharashtra		693.0	627.0	1320.0	0.3		-9.5
UP	219062.8	89340.1	36154.1	344557.0	86.1	-59.2	-59.5

Figure 14: Trends in market arrival in selected states: Banana

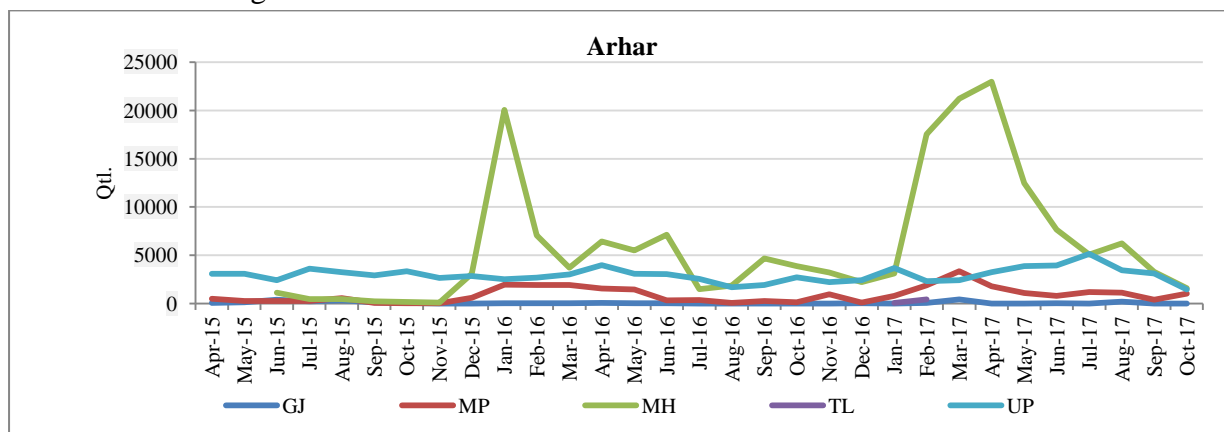


However, in terms arhar, Maharashtra reported to be the major market with arrival of 59 per cent of share and Uttar Pradesh falls second with 30 per cent of arrival. Whereas the least 0.2 per cent of arhar arrival in Gujarat market is reported (Table 16). The trends in market arrival of arhar in selected states as shown in Figure 15, states that the arrival is higher in Maharashtra during Dec-March, 2016 and Jan-Jun, 2017. Particularly it represents highest arrival in the month of January, 2016 and April, 2017.

Table 16: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Arhar

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Gujarat	1519.5	747.4	270.9	2537.8	0.9	-50.8	-63.8
MP	8456.9	11355.9	7461.3	27274.1	9.2	34.3	-34.3
Maharashtra	38255.0	78302.0	59307.0	175864.0	59.0	104.7	-24.3
Telangana		493.1		493.1	0.2		
UP	35517.7	32058.5	24267.3	91843.5	30.8	-9.7	-24.3

Figure 15: Trends in market arrival in selected states: Arhar



For gram, the highest per cent of arrival is recorded in Madhya Pradesh (80%), whereas only 14 per cent in Uttar Pradesh, 6.5 per cent in Maharashtra and 01 per cent in Haryana (Table 17). Gram arrived majorly in the month of April in 2016 and 2017 and it fluctuates in rest of the months with a declining trend (Figure 16). Similar to the gram, Madhya Pradesh (82%) is the major market in terms of total share of urad arrival (Table 18). Though the arrival of urad in Madhya Pradesh is fluctuating over the months, it shows increasing trend (Figure 17). However for cotton, Haryana is the major market and its arrival is highest in the month of December, 2016 (Table 19 and Figure 18).

Table 17: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Gram

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Haryana			593.4	593.4	0.1		
MP	96095.6	369532.1	274400.8	740028.5	79.8	284.5	-25.7
Maharashtra	12273.0	22473.0	24307.0	59053.0	6.4	83.1	8.2
UP	35758.2	48590.5	42956.9	127305.6	13.7	35.9	-11.6

Figure 16: Trends in market arrival in selected states: Gram

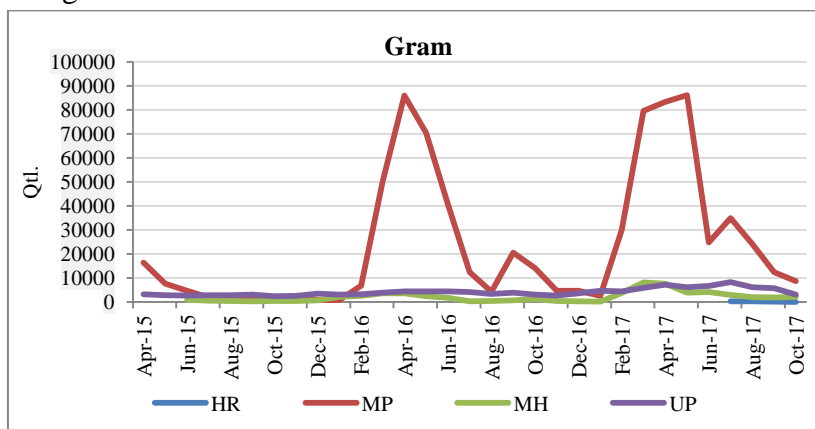


Table 18: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Urad

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Gujarat	465.1	122.1	51.0	638.2	0.5	-73.7	-58.2
Haryana	766.2	340.2	134.9	1241.3	0.9	-55.6	-60.3
MP	32319.6	51344.6	32157.2	115821.4	82.4	58.9	-37.4
Maharashtra	766.0	9490.0	3530.0	13786.0	9.8	1138.9	-62.8
UP	3108.8	2517.4	3470.0	9096.2	6.5	-19.0	37.8

Figure 17: Trends in market arrival in selected states: Urad

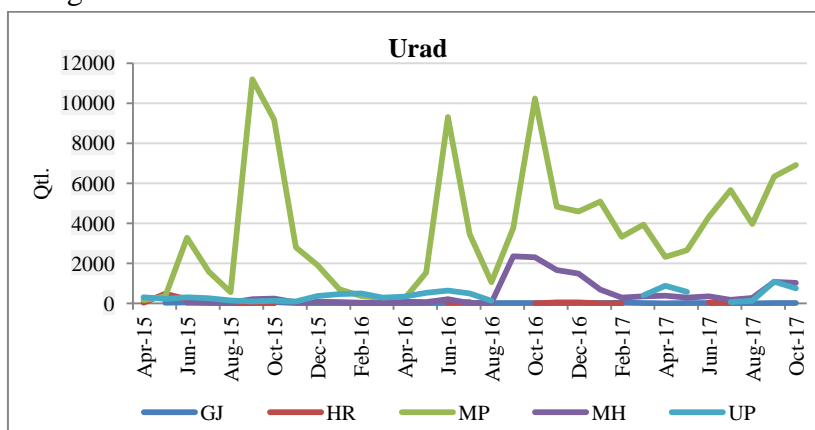
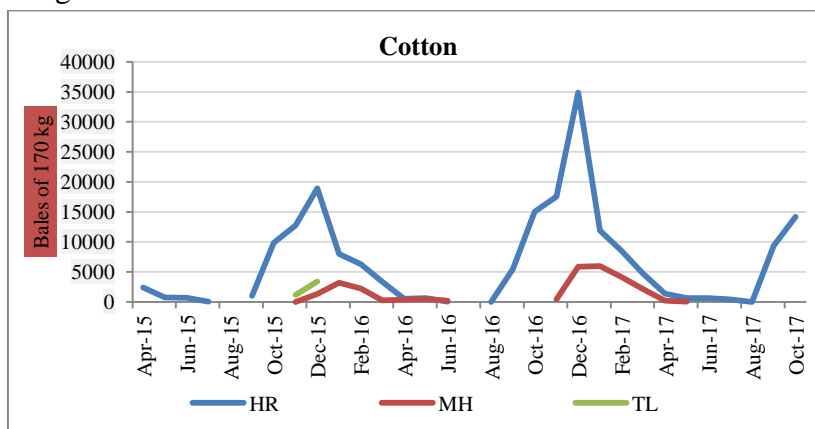


Table 19: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Cotton

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Haryana	63984.4	99200.2	26658.0	189842.6	85.8	55.0	-73.1
Maharashtra	6979.0	19525.0	283.0	26787.0	12.1	179.8	-98.6
Telangana	4588.1	1.5		4589.6	2.1	-100.0	

Figure 18: Trends in market arrival in selected states: Cotton



For moong arrival, Madhya Pradesh, Gujarat, Maharashtra and Uttar Pradesh are the major markets with 47, 24, 26 and 11 per cent of arrival respectively (Table 20). Figure 19 shows that arrival of moong to the market in Madhya Pradesh is highest in the month of June 2016. Again Madhya Pradesh is the major market for groundnut which records 83 per cent (Table 21). The highest arrival of groundnut has been reported during December-February, 2017 (Figure 20).

Table 20: Market arrivals in pre-eNAM and post-eNAM periods in the selected states:

Moong

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Gujarat	11335.6	2362.6	1190.0	14888.2	23.9	-79.2	-49.6
Haryana	0.3	338.5	853.1	1191.9	1.9	11.3	152.0
MP	8161.4	15679.0	5575.2	29415.6	47.3	92.1	-64.4
Maharashtra	1650.0	4202.0	4310.0	10162.0	16.3	154.7	2.6
UP	219.1	1532.0	4792.5	6543.6	10.5	599.2	212.8

Figure 19: Trends in market arrival in selected states: Moong

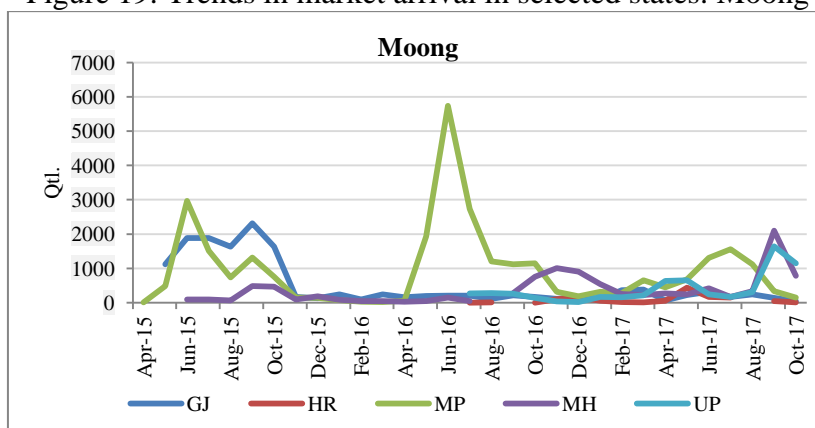
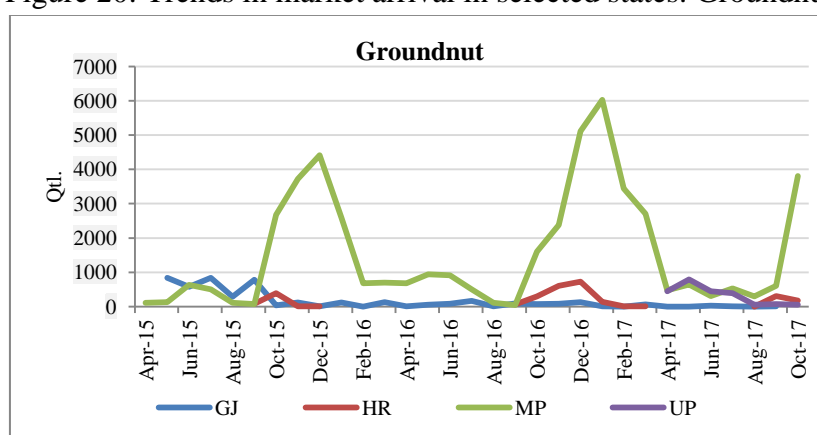


Table 21: Market arrivals in pre-eNAM and post-eNAM periods in the selected states:

Groundnut

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Gujarat	3741.9	751.5	44.1	4537.5	8.0	-79.9	-94.1
Haryana	488.5	1842.3	473.9	2804.7	4.9	277.1	-74.3
MP	16349.6	24450.1	6667.6	47467.3	83.2	49.5	-72.7
UP			2255.7	2255.7	4.0		

Figure 20: Trends in market arrival in selected states: Groundnut



Gujarat is the major market for jowar over the time period and its arrival is mainly during April-October, 2015 (Table 22 & Figure 21). On the other side, Table 23 represents that Uttar Pradesh (62%) is the major market for maize followed by Madhya Pradesh (13%) and Gujarat (12%). If we look at the trend in maize arrival, it started increasing in the month June and reached to the peak point in August and started declining in 2017 (Figure 22). Similarly for mango the major market is Uttar Pradesh representing 85 per cent of total share arrival (Table 24). This arrival is mostly high in the month of June in every year (Figure 23). Though the arrival of mango takes place in Haryana and Maharashtra but its share is significantly lower.

Table 22: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Jowar

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Gujarat	20584.7	4313.5	2051.2	26949.4	78.1	-79.0	-52.4
Haryana		28.0	15.0	43.0	0.1		-46.4
MP	446.5	2165.1	134.2	2745.8	8.0	384.9	-93.8
Maharashtra	109.0	1721.0	911.0	2741.0	7.9	1478.9	-47.1
Telangana		1.1		1.1	0.0		
UP			2005.0	2005.0	5.8		

Figure 21: Trends in market arrival in selected states: Jowar

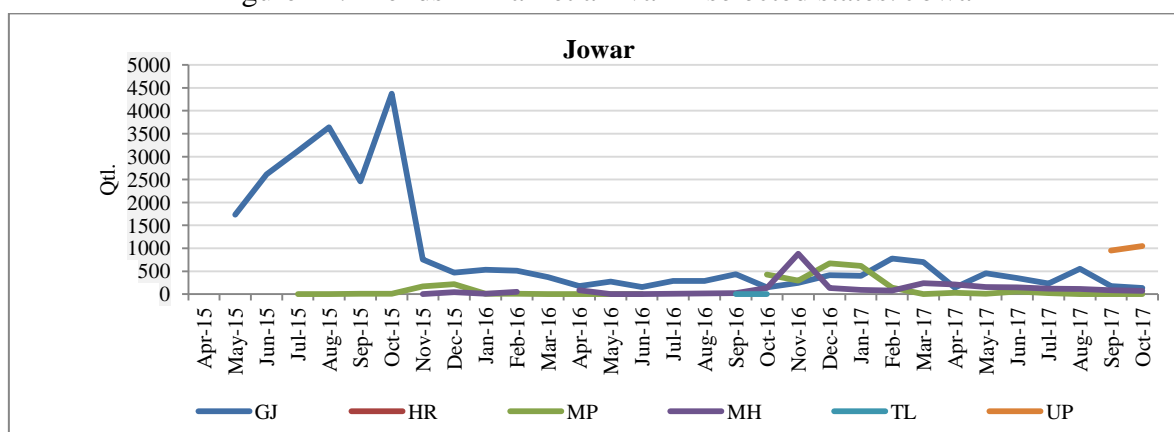


Table 23: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Maize

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Gujarat	16044.3	2311.7	1514.6	19870.6	12.1	-85.6	-34.5
Haryana	2345.0	4195.6	2522.5	9063.1	5.5	78.9	-39.9
MP	7345.1	11338.8	1798.3	20482.2	12.5	54.4	-84.1
Maharashtra	51.0	157.0	92.0	300.0	0.2	207.8	-41.4
Telangana	3855.1	8612.1	64.8	12532.0	7.7	123.4	-99.2
UP	26895.9	33202.2	41264.0	101362.1	62.0	23.4	24.3

Figure 22: Trends in market arrival in selected states: Maize

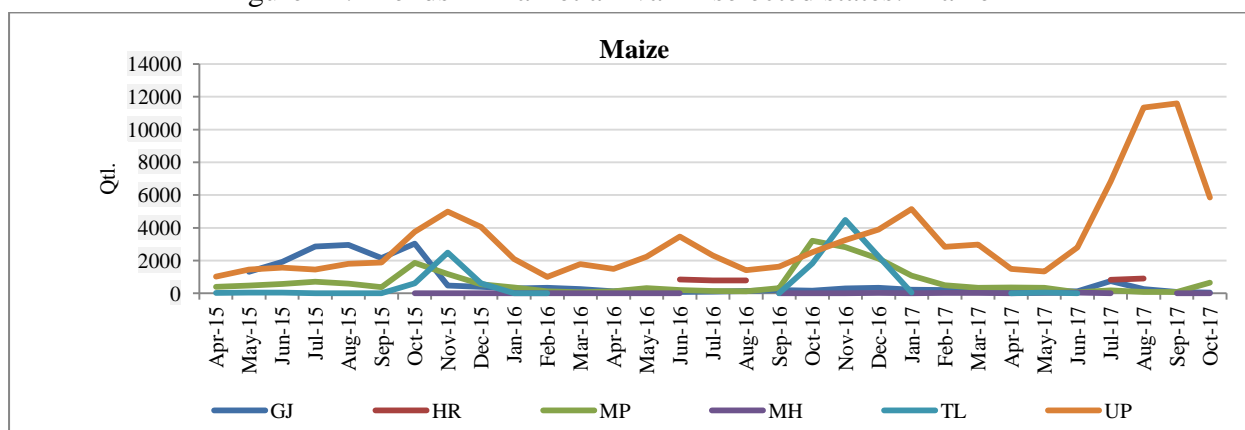


Table 24: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Mango

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Haryana	3990.9	3757.1	6326.3	14074.3	11.4	-5.9	68.4
Maharashtra	29.0	2191.0	2305.0	4525.0	3.7	7455.2	5.2
UP	58346.0	43307.0	3599.0	105252.0	85.0	-25.8	-91.7

Figure 23: Trends in market arrival in selected states: Mango

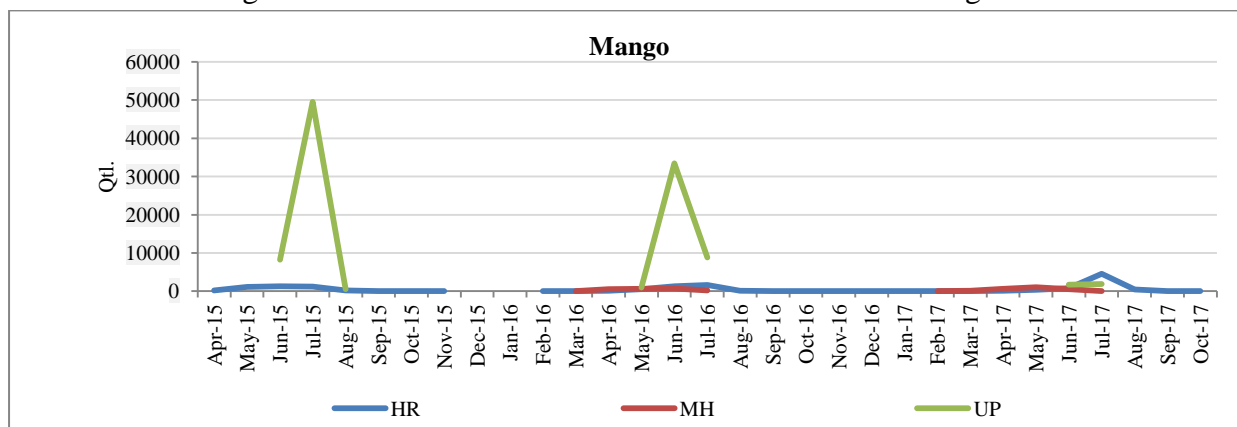


Table 25 shows the market arrival of mustard in three states. The highest share of arrival in term of apple is in the markers of Uttar Pradesh (69) followed by Haryana (16%), Madhya Pradesh (15%) and the least share in Gujarat (0.03) over the years. Figure 24 also shows the similar trend that arrival in Uttar Pradesh is higher than Haryana and Madhya Pradesh. Here the mustard arrival is fluctuating over the periods. Again Uttar Pradesh reported to be the major market followed by Maharashtra in terms of onion with arrival of 52 and 36 per cent of share respectively. Whereas the least 0.4 per cent of onion arrival in Telangana market is reported (Table 26). The trends in market arrival of onion in selected states as shown in Figure 25, states that the arrival is higher in Uttar Pradesh during Dec-February, 2016 and declining trend in 2017.

Table 25: Market arrivals in pre-eNAM and post-eNAM periods in the selected states:
Mustard

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Gujarat	35.0	39.8	1.2	76.0	0.03	13.7	-97.0
Haryana	17979.2	12267.5	10059.9	40306.6	16.3	-31.8	-18.0
MP	16740.4	13775.7	7241.9	37758.0	15.2	-17.7	-47.4
UP	59303.3	68474.4	41875.5	169653.2	68.5	15.5	-38.8

Figure 24: Trends in market arrival in selected states: Mustard

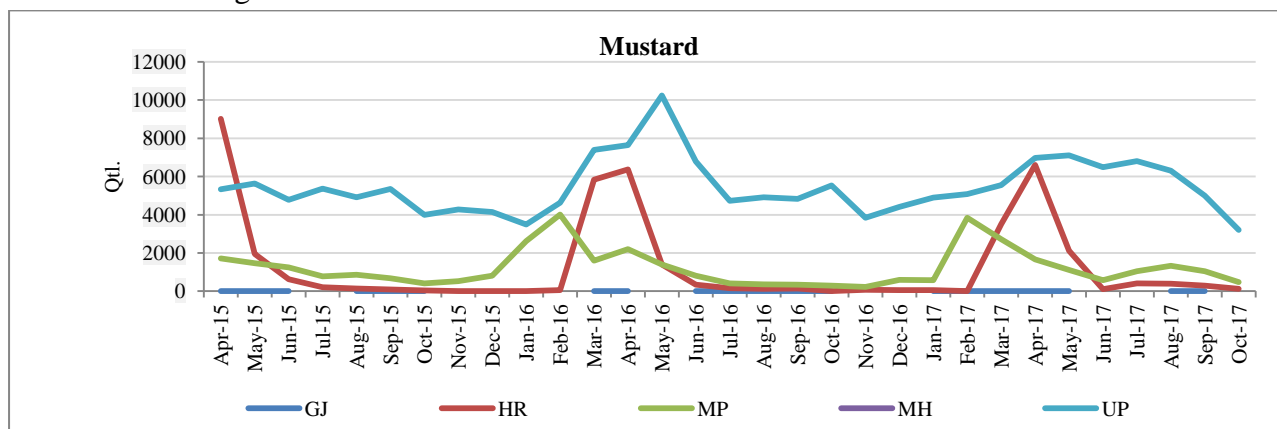


Table 26: Market arrivals in pre-eNAM and post-eNAM periods in the selected states:

Onions

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Haryana	15931.7	16301.3	25390.8	57623.8	5.2	2.3	55.8
MP	23122.1	21551.0	4620.2	49293.3	4.5	-6.8	-78.6
Maharashtra	113805.0	178561.0	119666.0	412032.0	37.5	56.9	-33.0
Telangana	1170.5	1039.3	2335.6	4545.4	0.4	-11.2	124.7
UP	221036.5	226780.4	127775.7	575592.6	52.4	2.6	-43.7

Figure 25: Trends in market arrival in selected states: Onions

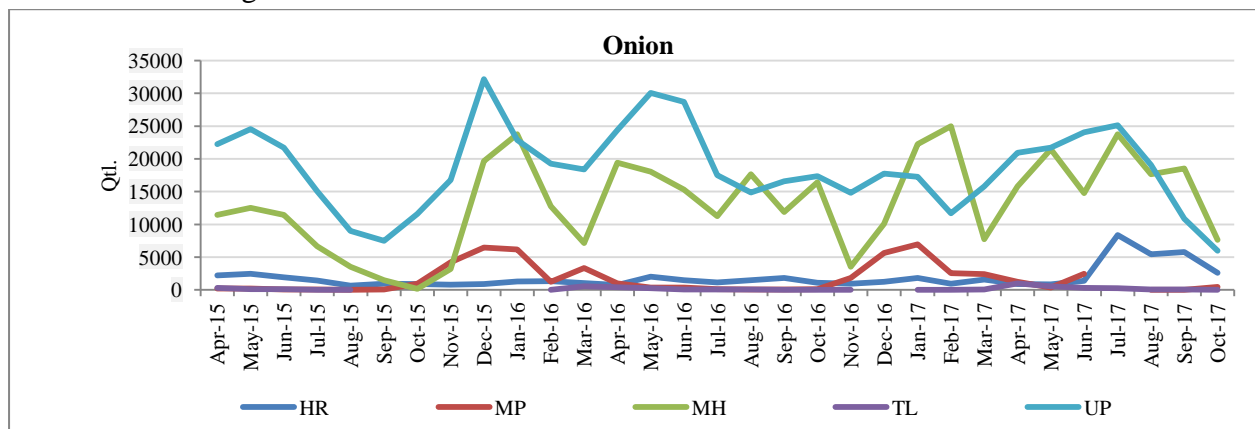
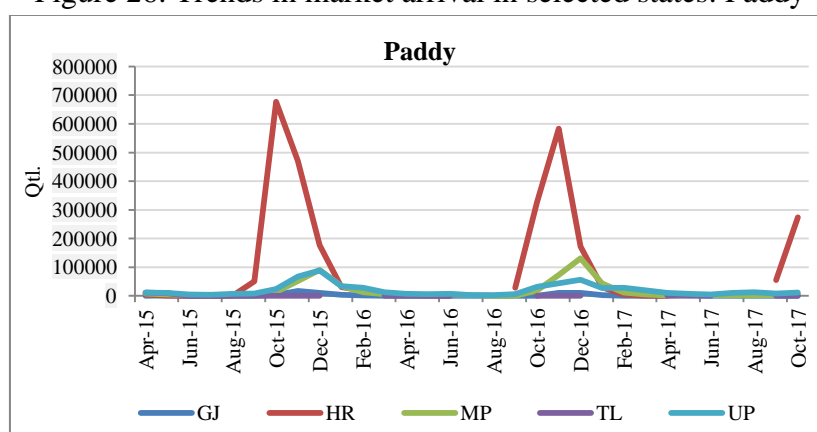


Table 27 shows that Haryana is the major market for paddy with 70 per cent of arrival, whereas Telangana are the least market with only 0.6 per cent. The trend in paddy arrival shows that the arrival has taken place mostly in the month of October, 2015 and 2016 after that it has declined till February, 2017 (Figure 26).

Table 27: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Paddy

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Gujarat	41261.0	26079.5	4878.6	72219.1	1.7	-36.8	-81.3
Haryana	1439800.9	1147707.8	328382.9	2915891.6	69.9	-20.3	-71.4
MP	235403.5	295150.5	17425.3	547979.3	13.1	25.4	-94.1
Telangana	21566.4	1589.7	2734.2	25890.3	0.6	-92.6	72.0
UP	303746.8	239393.1	65123.8	608263.7	14.6	-21.2	-72.8

Figure 26: Trends in market arrival in selected states: Paddy



For potato, the highest per cent of arrival is recorded in Uttar Pradesh (90), whereas only 5.5 per cent in Haryana, 4.5 per cent in Madhya Pradesh and less than one per cent in Telangana (Table 28). Though the potato arrived majorly Uttar Pradesh, it fluctuates over the months and declined in October 2017 (Figure 27). For tomato, Gujarat (41%) is the major market followed by Uttar Pradesh (36%) (Table 29). Though the arrival of Tomato in Gujarat and Uttar Pradesh higher, it is fluctuating over the months and declined at the end year 2017 (Figure 28). However for wheat, Haryana (38%) is the major market and its arrival is highest in the month of April, 2016 and May, 2017 (Table 30 and Figure 29). This result shows that wheat arrival is comparatively less over the time period considered for the analysis.

Table 28: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Potato

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Haryana	45194.5	38801.4	41985.3	125981.2	5.5	-14.1	8.2
Maharashtra	24645.0	51353.0	26059.0	102057.0	4.5	108.4	-49.3
Telangana		10.0	9.0	19.0	0.001		-10.0
UP	939595.0	642198.8	464261.0	2046054.8	90.0	-31.7	-27.7

Figure 27: Trends in market arrival in selected states: Potato

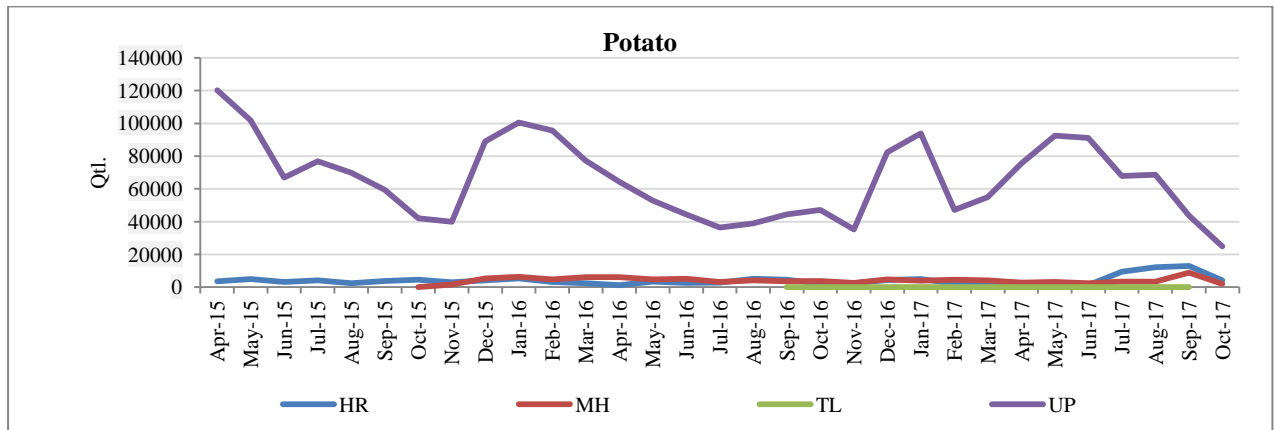


Table 29: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Potato

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Gujarat	68049.9	63245.8	44472.1	175767.8	40.6	-7.1	-29.7
Haryana	13082.3	11806.4	15021.8	39910.5	9.2	-9.8	27.2
Maharashtra	10929.0	36177.0	11515.0	58621.0	13.5	231.0	-68.2
Telangana	398.1	404.5	347.2	1149.8	0.3	1.6	-14.2
UP	46154.9	69709.7	41439.9	157304.5	36.3	51.0	-40.6

Figure 28: Trends in market arrival in selected states: Tomato

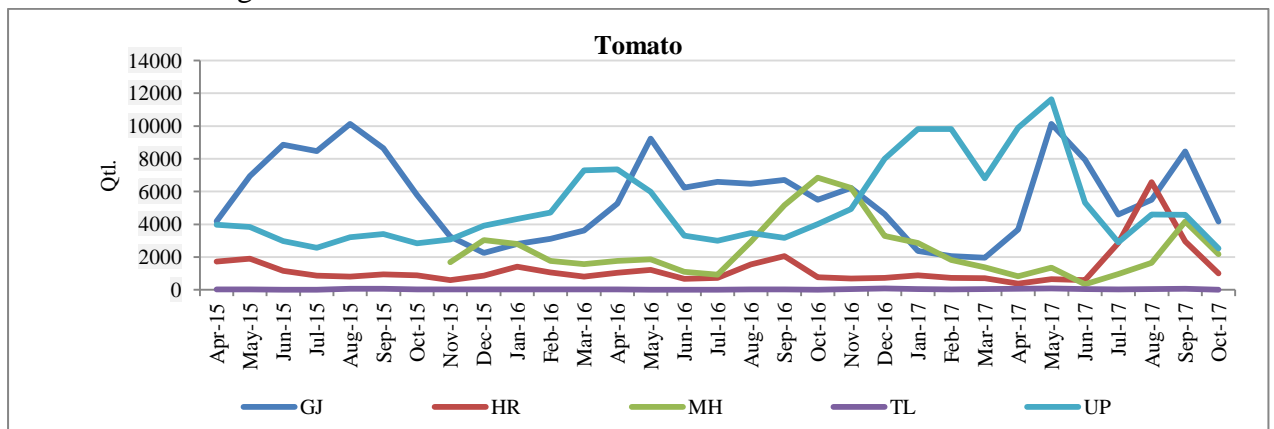
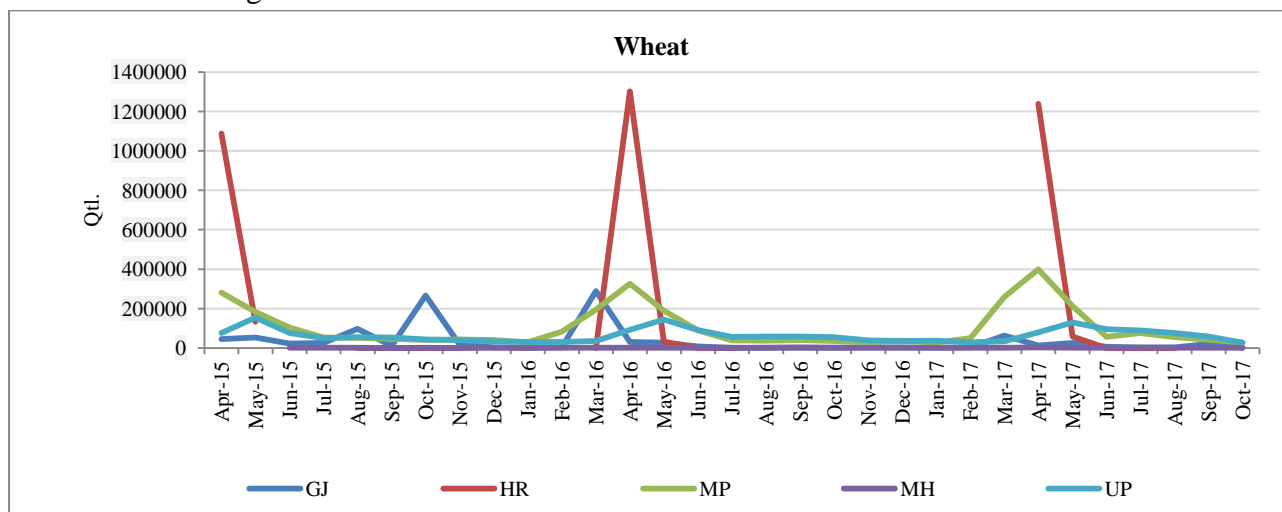


Table 30: Market arrivals in pre-eNAM and post-eNAM periods in the selected states: Wheat

States	2015-16	2016-17	2017-18 (Oct.)	Total arrival (Apr 2015-16 to Oct 2017-18)	Total arrival (state share)	% change (2016-17 w.r.t. 2015-16)	% change (2017-18 (oct.) w.r.t. 2016-17)
Gujarat	831198.2	144521.7	70579.0	1046298.9	10.4	-82.6	-51.2
Haryana	1220990.0	1333799.1	1298691.9	3853481.1	38.4	9.2	-2.6
MP	1147125.9	1156078.1	866046.1	3169250.1	31.6	0.8	-25.1
Maharashtra	2320.0	5164.0	4213.0	11697.0	0.1	122.6	-18.4
UP	674892.0	725350.6	553123.7	1953366.3	19.5	7.5	-23.7

Figure 29: Trends in market arrival in selected states: Wheat



4.1. Market price volatility over two time periods in the selected states: Price volatility in paddy over two times point (2015-17 and 2017-18) is presented in Table 31. The result showed that price volatility has decreased in all the states over the period except the Haryana. Though the farmers from Haryana have received higher price in paddy, this impacts is decreased in other states.

Table 31: Market price volatility in pre-eNAM and post-eNAM periods in the selected states for foodgrains

State	Apr 2015-16 to Oct 2017-18	Oct 2017-18 to Mar 2018-19
Paddy		
Gujarat	0.133	0.062
Haryana	0.090	0.169
MP	0.103	0.038
Telangana	0.070	0.017
UP	0.021	0.087
Wheat		
Gujarat	0.038	0.070
Haryana	0.035	NA
MP	0.036	0.045
Maharashtra	0.047	0.042
UP	0.030	0.023
Jowar		
Gujarat	0.079	0.086
MP	0.296	0.148
Maharashtra	0.082	0.021
Telangana	NA	0.317
Maize		
Gujarat	0.058	0.060
Haryana	0.014	NA
MP	0.104	0.062
Maharashtra	0.074	0.080
UP	0.027	0.034

The market price volatility in case of wheat has increased in Gujarat, Haryana and Madhya Pradesh but has decreased in Uttar Pradesh and Maharashtra (Table 31). It is higher in Gujarat followed by Madhya Pradesh. This shows that farmers from Gujarat, Haryana and Madhya Pradesh have received higher price over the period (Apr 2015-16 to Oct 2017-18 and Oct 2017-18 to Mar 2018-19). Though the maize has reported low price volatility in Madhya Pradesh, it has increased in Gujarat, Haryana, Maharashtra and Uttar Pradesh over the time periods. Farmers have received higher price volatility. This shows that price for maize have increased from the year 2015-17 to 2017-18 and farmers have received profit (Table 31). As can be seen from the same table, though jowar reported lower price volatility in Maharashtra and Madhya Pradesh, it is higher in Gujarat and Telangana during Apr 2015-16 to Oct 2017-18 and Oct 2017-18 to Mar 2018-19.

Market price volatility for the crop arhar over two time periods in the selected states shows that it has decreased sharply in all the states (Table 32). Though it has increased (from 0.143 to 0.144) in Gujarat, the increment is not significantly high with respect to other states. This shows that farmers have not received price volatility in the crop arhar (Table 32). The market in Madhya Pradesh has reported price volatility in terms of gram, whereas it has decreased in markets of Maharashtra and Uttar Pradesh over the time period (Table 32). This shows that price for the crop gram has been declined during the years 2015-17 and 2017-18, implying farmers from Maharashtra and Uttar Pradesh have not received price volatility in gram. However, farmers from Madhya Pradesh have received price volatility.

Table 32 shows market price volatility over two time periods in the selected states in moong. Moong has reported lower price volatility during the periods (Apr 2015-16 to Oct 2017-18 and Oct 2017-18 to Mar 2018-19) in all the states except Gujarat. This shows that all the major markets from Gujarat for moong have reported high price volatility, stating farmers have profits in moong during the same period. But when we look at price volatility for masur for the same period, it has declined in both Madhya Pradesh and Uttar Pradesh (Table 32). This shows that farmers have received lower price volatility in these states which not expected in implementation of e-NAM.

Table 32: Market price volatility in pre-eNAM and post-eNAM periods in the selected states for pulses

State	Apr 2015-16 to Oct 2017-18	Oct 2017-18 to Mar 2018-19
Arhar		
Gujarat	0.143	0.144
MP	0.113	0.071
Maharashtra	0.103	0.052
Telangana	n.a	0.081
UP	0.076	0.025
Gram		
MP	0.116	0.125
Maharashtra	0.168	0.127
UP	0.071	0.006
Moong		
Gujarat	0.050	0.153
Haryana	0.522	0.336
MP	0.099	0.053
Maharashtra	0.066	0.044
UP	0.065	0.069
Masur		
MP	0.077	0.042
UP	0.034	0.048

In terms of mustard, the markets across the selected states in India has shown lower price volatility during the periods 2015-17 to 2017-18 which presented in Table 33. This shows that the impact of e-NAM is less on price volatility for mustard. However, the price volatility for groundnut has increased in Haryana, Madhya Pradesh, Telangana and Uttar Pradesh, showing higher price volatility as expected. But groundnut has reported lower price volatility in Gujarat (Table 33). Even when we analyse the price volatility for cotton, it has not only decreased in Haryana but also in Maharashtra over the same time period (Table 44). However, market price volatility for soyabean over two time periods has reportedly increased in Madhya Pradesh and Maharashtra, implying higher price received by the farmers of these states in soybean (Table 33).

Table 33: Market price volatility in pre-eNAM and post-eNAM periods
in the selected states for oilseeds and cotton

State	Apr 2015-16 to Oct 2017-18	Oct 2017-18 to Mar 2018-19
Mustard		
Gujarat	0.062	0.029
Haryana	0.059	0.043
MP	0.062	0.039
Maharashtra		0.079
UP	0.035	0.014
Groundnut		
Gujarat	0.081	0.020
Haryana	0.095	0.196
MP	0.083	0.111
UP	0.050	0.108
Soybean		
MP	0.054	0.061
Maharashtra	0.046	0.054
Cotton		
Haryana	0.096	0.045
Maharashtra	0.069	0.058
Telangana		0.043

5. Performance of eNAM in selected states: Analysis of field survey data

In the previous Section, we have discussed the performance of e-NAM and its impact on stakeholders using secondary data. In addition, in this chapter, surveyed data collected and compiled from six different states and have been analysed to understand in depth not only the impact of e-NAM on stakeholders but also perceptions on e-NAM.

5.1. Characteristics of the sampled households: Before we go for analysis, it is essential to know about the characteristic of sample households, because the part of human knowledge is absolutely connected with the society. Due to this the society will well understand what the social needs for growing population.

Table 34 shows sample households surveyed across states. In the state Gujarat, 106 households were surveyed. Similarly in Haryana and Madhya Pradesh 150 households each, Maharashtra and Telangana 100 households each and Uttar Pradesh 250 households, thus a total of 856 households were surveyed (Table 34). Out of 856 household surveyed, highest number of respondents (more than 29 per cent of farmers) from Uttar Pradesh, implying highest among states selected for survey followed by Haryana and Madhya Pradesh reported to be second highest (17.5%) highest follows by Gujarat (12.4%) and Maharashtra and Telangana (11.7%).

Table 34: Sampled households across states

State	Number of households	Percent	Cumulative distribution
Gujarat	106	12.4	12.4
Haryana	150	17.5	29.9
Madhya Pradesh	150	17.5	47.4
Maharashtra	100	11.7	59.1
Telangana	100	11.7	70.8
Uttar Pradesh	250	29.2	100
Overall	856	100	

As mentioned in the methodology a total of 338 villages coming under 83 blocks and 21 APMCs in 23 districts across 6 states in India are covered for survey (Table 35). In the states Haryana, 105 villages have been surveyed in 3 districts; however, only 8 villages from Maharashtra are recorded from 2 districts which is lowest among states considered for survey.

Table 35: Coverage of sample households across states for the study

State	Districts	APMCs	Blocks	Villages
Gujarat	2	2	2	12
Haryana	3	4	7	105
Madhya Pradesh	4	5	14	76
Maharashtra	2	3	3	8
Telangana	6	2	21	38
Uttar Pradesh	6	5	36	99
Overall	23	21	83	338

Table 36: Education profile of sample households

Category	Gujarat	Haryana	MP	Maharashtra	Telangana	UP	Overall
Number of households							
Illiterate	4	7	6	12	35	20	84
Primary	4	16	11	10	14	33	88
Secondary	18	30	39	20	17	66	190
High School	36	59	50	29	16	60	250
Higher	44	30	44	29	18	71	236
Overall	106	142	150	100	100	250	848
Percent							
Illiterate	3.8	4.9	4.0	12.0	35.0	8.0	9.9
Primary	3.8	11.3	7.3	10.0	14.0	13.2	10.4
Secondary	17.0	21.1	26.0	20.0	17.0	26.4	22.4
High School	34.0	41.6	33.3	29.0	16.0	24.0	29.5
Higher	41.5	21.1	29.3	29.0	18.0	28.4	27.8
Overall	100	100	100	100	100	100	100.0
<i>Note: Illiterate (Never went to school), Primary (Class 1 to 4), Secondary (Class 5 to 7), High school (Class 8 to 10), Higher (Above class 10).</i>							

Education statistics give details knowledge on participation in e-NAM. Table 36 shows both literacy and illiteracy in percentage term. Literacy ratio is categorized into primary, secondary, high school and higher education. Among the sample respondent across states, the highest 42 per cent of respondent are in higher education in the state Gujarat and Haryana, 33

and 29 per cent of respondents are in high school in the state Madhya Pradesh and Maharashtra respectively and 28 per cent of respondent are in higher education in Uttar Pradesh. The highest 35 per cent of illiterate respondents are recorded in Telangana. Overall highest 29 per cent of respondent are reported to be in high school. In concluding remarks, most of the respondents have obtained high school or higher education all the states selected except Telangana.

5.2. Farm Characteristics of sampled households: In India, population is growing rapidly and Indian agriculture has to feed all. Mostly India has continuation agriculture where farmer owns a small piece of land which is crucial issue in India agricultural sector today. In this study the characteristics of the study area is discussed.

Table 37 indicates the number of sampled farmers in particular farm class. While 49 per cent of marginal farmers are recorded in Gujarat, 35 and 99 per cent are in Telangana and Uttar Pradesh. Around 36 and 42 per cent of medium farmers are found in Haryana and Maharashtra respectively while more than 50 per cent of large farmers are found in Madhya Pradesh. While landless farmers are 0.9 percent in Gujarat, 0.7 per cent in Madhya Pradesh and 4 per cent in Uttar Pradesh, none of the same is found in Haryana, Maharashtra and Telangana. Overall highest 28.6 percent of marginal farmers and lowest 1.4 per cent of landless farmers are noticed among the sampled farmers.

Table 37: Farm size category-wise distribution of sampled farm households

Category	Gujarat	Haryana	MP	Maharashtra	Telangana	UP	Overall
Number of households							
Landless	1		1			10	12
Marginal	52	36	8	15	35	99	245
Small	33	35	27	24	30	64	213
Medium	13	55	38	42	25	56	229
Large	7	24	76	19	10	21	157
Overall	106	150	150	100	100	250	856
Percent							
Landless	0.9		0.7			4.0	1.4
Marginal	49.1	24.0	5.3	15.0	35.0	39.6	28.6
Small	31.1	23.3	18.0	24.0	30.0	25.6	24.9
Medium	12.3	36.7	25.3	42.0	25.0	22.4	26.8
Large	6.6	16.0	50.7	19.0	10.0	8.4	18.3
Overall	100	100	100	100	100	100	100.0

The classification of land in acres in different states is presented in Table 38. The state Madhya Pradesh records highest average owned land (13.1), leased in land (3.1), leased out land (0.04), and operational land (16.2) and irrigated land (14.9) across stated selected in the study. While in Gujarat the average owned land is lowest (3.7), the lowest leased in land (0.3)

is found in Maharashtra and Telangana, the lowest operational land (4.6) is found in Uttar Pradesh, the lowest irrigated land (3.0) is found in Maharashtra. In case of un-irrigated land, more land is found in Maharashtra followed by Madhya Pradesh.

Table 38: Average size of land holding for all size categories of sampled households (In acres)

State	Own land	Leased in land	Leased out land	Operational land	Irrigated land	Un-irrigated land (if any)
Gujarat	3.7	1.4	0.00	5.1	5.0	0.03
Haryana	5.9	0.6	0.03	6.5	6.4	0.06
MP	13.1	3.1	0.04	16.2	14.9	1.01
Maharashtra	6.2	0.3	0.00	6.5	3.0	2.82
Telangana	4.7	0.3	0.00	5.0	4.6	0.41
Uttar Pradesh	4.0	0.5	0.00	4.6	4.6	0.02
Overall	6.2	1.1	0.01	7.3	6.6	0.57

5.3. Performance of e-NAM: Testing of quality parameters is as important as price discovery in the concept of e-NAM setup. While 68.8 per cent of farmers from Gujarat opined that testing of quality parameters is transparent, 67 percent of farmers from Maharashtra and 60 percent of farmers from Telangana are also experienced transparent in quality parameters. On the other hand highest per cent of Telangana farmers (67%) have received a report on testing of quality and highest per cent of Maharashtra farmers (76%) said that rate testing of quality parameters are alright, liberal and very liberal (Table 39).

Table 39: Farmers perceptions of testing of quality parameters in eNAM mandis

State	Percent distribution		
	Testing of quality parameters - "Transparent"	Received a report on testing of quality - "Yes"	Rate testing of quality parameters - "alright, liberal and very liberal"
Gujarat	18.5	7.4	47.8
Haryana	68.8	48.2	66.7
Madhya Pradesh	0.0	0.0	34.7
Maharashtra	67.0	6.0	76.0
Telangana	60.0	67.0	21.0
Uttar Pradesh	15.6	12.4	32.1
Overall	66.4	21.7	46.7

Table 40: Proportion of farmers perceiving e-NAM to be better than manual mandi

State	Percent distribution		
	Worse and No change	Better and much better	Overall
Gujarat	18.5	81.5	100.0
Haryana	20.7	79.3	100.0
Madhya Pradesh	100.0	0.0	100.0
Maharashtra	36.0	64.0	100.0
Telangana	11.0	89.0	100.0
Uttar Pradesh	84.0	16.0	100.0
Overall	55.7	44.3	100.0

Around 100 per cent of respondents from Madhya Pradesh have confessed that use of e-NAM is worse and they have noticed no change after the introduction of the e-NAM. The similar information is give by 84 per cent of respondents from Uttar Pradesh and overall more than half of the respondent reported that e-NAM is worse than manual mandi before. But it was understood that around 82 per cent of respondent from Gujarat, 79 per cent from Haryana, 64 percent from Maharashtra and 89 per cent from Telangana have noticed better price and facilities for transaction cost after e-NAM (Table 40).

Table 41: Percentage of farmers reporting about facilities available in mandis across states

States with 'Yes' %	Cleaning	Sorting	Drying	Grading	Weighing	Assaying	Bid management	e-auction	Grain storage	Soil testing	Cold storage
Gujarat	12.8	6.8	5.4	20.3	80.0	4.2	30.6	4.1	40.8	67.1	2.9
Haryana	94.7	30.9	15.5	29.1	100.0	75.0	84.0	74.7	38.1	n.a.	n.a.
MP	0.0	0.0	0.0	0.0	100.0	14.7	100.0	3.3	2.7	n.a.	n.a.
Maharashtra	8.0	7.0	1.0	67.0	100.0	86.0	100.0	99.0	73.7	n.a.	n.a.
Telangana	100.0	50.0	100	50.0	100.0	100.0	100.0	100.0	50.0	50.0	n.a.
Uttar Pradesh	80.4	14.8	8.0	28.0	94.8	18.0	18.0	14.0	0.4	n.a.	n.a.
Overall	55.7	17.6	18.0	29.8	96.6	44.8	66.1	42.8	26.2	12.0	0.2

Table 41 shows about 100 per cent of farmers from Telangana have reported satisfaction with the cleaning, drying, weighing, assaying, bid management and e-auction and more that 50 per cent of the same farmers have satisfied in sorting and grading. While 100 per cent of farmers from Haryana, Madhya Pradesh and Maharashtra have reported satisfaction with weighing facility and Madhya Pradesh and Maharashtra with Bid management, only 95 and per cent of farmers from Haryana and Gujarat have satisfied with cleaning and weighing respectively. Over all farmers from Uttar Pradesh, Telangana and Haryana reported satisfaction with the facilities of e-NAM.

Table 42: Percentage of farmers expressing satisfaction about quality of facilities in mandi

States	Cleaning	Sorting	Drying	Grading	Weighing	Assaying	Bid management	e-auction	Grain storage	Soil testing	Cold storage
Gujarat	100.0	100.0	100.0	100.0	84.7	0.0	95.2	50.0	96.8	93.8	100.0
Haryana	90.1	87.0	65.2	81.4	93.3	89.2	90.5	89.9	73.2	n.a.	n.a.
MP	n.a.	n.a.	n.a.	n.a.	72.7	77.3	70.7	100.0	0.0	n.a.	n.a.
Maharashtra	50.0	28.6	0.0	56.7	96.0	58.1	93.0	78.8	89.0	n.a.	n.a.
Telangana	85.0	100.0	98.0	100.0	93.0	98.0	100.0	100.0	100.0	94.0	n.a.
UP	96.0	97.3	85.0	87.1	96.7	95.6	88.9	94.3	100.0	n.a.	n.a.
Overall	90.5	91.7	90.5	81.2	89.6	83.9	87.3	90.0	87.0	93.9	100.0

Table 42 shows that most the farmers are happy with the cleaning, sorting, drying, grading, weighing, assaying, bid management, e-auction, grain storage, soil testing and cold storage across selected states. Conversely, the quality of facilities varies from 81 per cent (grading) to 100 per cent (cold storage). More than 90 per cent reported to have received quality of facilities across states except Madhya Pradesh which sort fall in cleaning, sorting, drying and grading.

Table 43: Percentage of farmers perceiving problems in eNAM

State	Gujarat	Haryana	MP	Maharashtra	Telangana	UP	Overall
No guidance or help desk	69	84	100	88	100	79	86
Grading facilities are not adequate	76	43	100	95	77	95	83
No refrigeration facilities	44	39	100	90	92	99	83
Sorting facilities are not adequate	72	51	100	99	52	97	82
Poor net connectivity	71	60	73	83	75	93	78
No soil testing laboratory	22	48	100	89	64	93	78
Not enough computers	67	66	89	60	69	90	77
Online payment process is difficult	46	54	89	87	16	97	76
Delay in online payment	9	57	100	83	16	91	74
Discovering prices is cumbersome	24	37	100	77	42	98	73
Cleaning facilities are not adequate	72	53	67	99	24	99	73
Quality parameters are stringent	72	37	100	71	8	94	70
Sale process is complicated than before	42	53	92	80	8	90	68
No trained manpower to help with e-NAM	85	49	100	52	36	76	68
Electronic system does not work/works occasionally	44	37	81	80	32	90	67
Weighing facilities are not adequate	69	33	100	45	32	90	67
Market is far away	5	35	67	69	58	98	66
Poor road network for transportation	20	57	75	83	9	89	65
Collusion among traders/trade malpractices	10	39	100	69	22	80	64
Frequent power failures	9	64	8	76	42	97	60
Labour problem for loading / unloading	78	43	100	67	48	20	52
Higher cost than pre e-NAM	16	40	24	8	43	75	42
Lower price than pre e-NAM	16	57	0	7	24	59	33
Higher mandi fees than before	20	29	0	33	0	7	13

Table 43 presents the problems faced by the farmers and traders in terms of physical, technical, online support, power supply, electricity facility, network connectivity, pricing, transaction cost, mandi fee, infrastructure, testing of quality parameters, working environment and etc. The highest percentage of respondents (85%) from Gujarat reported lack of trained manpower to help with e-NAM. Most of them also reported that there is no

guidance or help desk, inadequate grading facilities, sorting facilities, poor net connectivity, labor problem in loading and uploading and etc. Around 84 per cent and 100 per cent of respondents from Haryana and Telangana have listed lack of guidance or help desk as major problem. Though the stakeholders of Madhya Pradesh face lots of problems at e-NAM, but sever problems listed by them are in guidance or help desk, grading, sorting, refrigeration, testing, online payments, manpower and price discovering. Stakeholders from Maharashtra and Uttar Pradesh are not exempted in facing major problems as lack of guidance or help desk followed by poor net connectivity, power failures and inadequate number of computers (70% to 99%). Overall 86 per cent of respondents reported lack of guidance or help desk as major problem followed by grading, sorting, refrigeration, testing and online payments problems.

Table 44: Percentage of farmers reporting serious problems in eNAM

State	Gujar at	Harya na	Madhya Pradesh	Maharash tra	Telanga na	Uttar Pradesh	Over all
Labour problem for loading / unloading	76	39	45	16	89	49	48
No soil testing laboratory	100	36	61	55	97	24	47
No trained manpower to help with e-NAM	74	19	61	21	86	36	46
Delay in online payment	50	25	92	17	86	19	41
Discovering prices is cumbersome	50	25	87	18	70	15	40
Online payment process is difficult	50	30	94	15	57	19	40
No refrigeration facilities	67	57	15	50	97	24	40
Not enough computers	62	35	21	25	97	31	38
Poor net connectivity	71	36	23	25	96	21	37
Sale process is complicated than before	79	22	81	16	50	16	36
Collusion among traders/trade malpractices	50	43	77	3	55	14	36
Frequent power failures	0	42	0	20	83	31	35
Cleaning facilities are not adequate	48	46	56	16	91	22	35
Poor road network for transportation	71	32	43	12	44	35	33
Sorting facilities are not adequate	60	49	40	15	22	28	33
Grading facilities are not adequate	60	50	29	18	80	12	31
Quality parameters are stringent	67	21	54	26	100	12	31
No guidance or help desk	84	25	66	2	17	7	29
Electronic system does not work/works occasionally	70	33	24	18	68	22	28
Higher cost than pre e-NAM	40	36	61	63	66	8	28
Weighing facilities are not adequate	53	25	30	11	77	10	24
Lower price than pre e-NAM	0	31	-	14	65	8	21
Market is far away	-	35	8	3	54	21	21
Higher mandi fees than before	43	5	5	27	-	28	15

Table 44 shows severity of problems faced by farmers at e-NAM. The problem is categorised into high and severer. A 100 per cent of farmers from Gujarat reported no soil testing laboratory and 84 per cent of them listed lack of guidance or help desk. More than 50 per cent of farmers from Haryana have confessed that quality parameters are stringent, 94 per cent and 92 per cent of farmers from Madhya Pradesh have mentioned that online payment process is difficult and delay in online payment respectively. Similarly 80 per cent to 100 per cent of

farmers have reported difficulties in online payments, poor net connectivity, absence of refrigeration facilities, collusion among traders, absence of trained manpower to help, difficulty in getting licenses, lack of help desk, physical and technical problems. However, between 30 to 49 percent of Uttar Pradesh farmers have revealed that they have faced above listed problems. Overall 48 per cent of farmers have reported Labour problem for loading / unloading and 46 per cent of farmers have reported there is no trained manpower to help with e-NAM. As a whole less than 40 per cent of farmers have faced the severity of problem such as electronic system, complicated sale process, higher mandi fee, difficulty in online payments, poor net connectivity, absence of refrigeration facilities, collusion among traders, absence of trained manpower to help, difficulty in getting licenses, discovering prices, cleaning, sorting, grading facilities and etc.

Table 45: Percentage of farmers reporting advantages of eNAM

state	Gujarat	Haryana	Madhya Pradesh	Maharashtra	Telangana	Uttar Pradesh	Overall
Better facilities for knowing quality of product	65	55	0	85	100	74	61
Higher price realization	96	68	0	91	81	48	56
Transparent procedures	75	53	0	92	81	50	52
Lower cost of marketing	94	26	0	17	84	87	51
Sale process is less complicated	72	54	0	70	93	45	49
Satisfaction of being part of the national market	64	33	0	74	100	48	47
Higher traded volume	66	22	0	82	100	43	45
Online payment is more convenient	67	60	0	67	100	37	44
Additional facilities like soil testing	78	31	0	44	48	33	32

When we look at the advantage of e-NAM (Table 45), more than 50 per cent stakeholders from across states reported better facilities for knowing quality of product (61%), higher price realization (56%), transparent procedures (52%) and lower cost of marketing (51%). Among the states selected, highest per cent of farmers from Telangana have realized advantages of e-NAM that is per cent of farmers have realized advantages in terms of better facilities for knowing quality of product, satisfaction of being part of the national market, higher traded volume and online payment is more convenient. They have also realized higher price realization (81%), transparent procedures (81%) and lower cost of marketing (84%), sale process is less complicated (93%), and additional facilities like soil testing (48%). Mostly the similar observation can be noted from the farmers of Gujarat followed by Maharashtra and

Haryana. However, farmers from Madhya Pradesh have not realized any advantage of e-NAM.

Table 46: Suggestions for improvement of eNAM by farmers (in % of farmers)

State	Gujarat	Haryana	Madhya Pradesh	Maharashtra	Telangana	Uttar Pradesh	Overall
Providing guidance / help at the mandi	56	67	100	82	44	49	65
Providing facilities for manual sale also	59	33	100	63	82	56	64
Creating/ Improving weighing facilities	68	51	100	57	41	57	63
Reducing delay in online transactions	77	42	100	65	2	49	59
Creating / Improving refrigeration facilities	73	39	100	58	42	48	59
Ensuring Single license for the entire country	64	44	100	50	35	52	58
Creating/improving sorting & grading infrastructure	65	31	100	55	27	46	54
Improving sale process through e-NAM	48	17	100	20	31	58	49

Farmers from across states have given suggestion, based on their experience on e-NAM, for improvement and fulfill the aim of the introduction of e-NAM (Table 46). Since the advantages of e-NAM has not been realized by the farmers of Madhya Pradesh, 100 per cent of them have suggested to provide guidance / help at the mandi, facilities for manual sale, Create or improve weighing facilities and refrigeration facilities, sorting facilities, grading facilities, sale process through e-NAM and infrastructure, reduce delay in online transactions and ensure single license for the entire country. Even more than 50 per cent of farmers from Gujarat, Maharashtra and Uttar Pradesh, and also overall farmers have agreed with the opinion of the farmers Madhya Pradesh for better advantage of e-NAM.

Table 47: Percentage of farmers utilizing eNAM mobile and sms alerts

state	Gujarat	Haryana	Madhya Pradesh	Maharashtra	Telangana	Uttar Pradesh	Overall
Have used the e-NAM mobile app	3	71	0	56	0	1	20
Do you get the SMS alert after the online payment	42	78	39	67	47	8	38

Table 47 shows farmers using e-NAM mobile app. The highest per cent of Haryana farmers are using e-NAM mobile app (71%) followed by Maharashtra (56%) and also have received SMS alert after the online payment (78) followed by Maharashtra (67%). However, so far no farmers from Madhya Pradesh and Telangana are using e-NAM mobile app. Only one and three percent of farmers from Uttar Pradesh and Gujarat are using e-NAM mobile app. Overall 20 per cent of farmers are using e-NAM mobile app and 38 per cent of them have received SMS alert after the online payment across the states selected for survey.

Table 48: Weighted price impact due to eNAM participation

Crop code	Crop names	Obs.	Prices - before and after			Value of output - before		Prices increase
			Before	After	Diff. (%)	In Rs.	Weights	Diff. (%)
1	Paddy	352	1840	2180	19	57366234.5	0.4751	8.79
2	Wheat	74	1599	1602	0	8215350	0.0680	0.01
3	Jowar	10	1865	1913	3	702100	0.0058	0.02
4	Bajra	17	1297	1301	0	222200	0.0018	0.00
5	Maize	77	1252	1219	-3	6964610	0.0577	-0.15
6	Tur	6	4175	4533	9	403390	0.0033	0.03
7	Gram	87	4417	4432	0	7990250	0.0662	0.02
8	Masur	19	4046	3214	-21	1897960	0.0157	-0.32
9	Moong	23	4707	4578	-3	579855	0.0048	-0.01
10	Urad	59	4915	2830	-42	6951420	0.0576	-2.44
11	Groundnut	6	3825	4483	17	359450	0.0030	0.05
13	Soyabean	1	2200	2400	9	26400	0.0002	0.00
14	Cotton	15	4247	5128	21	5502950	0.0456	0.95
16	Fruits	38	478	507	6	2720980	0.0225	0.13
19	Vegetable 1	103	435	382	-12	15517665	0.1285	-1.58
20	Vegetable 2	4	1225	1264	3	315600	0.0026	0.01
21	Vegetable 3	4	1271	1323	4	207180	0.0017	0.01
22	Others	47	1879	1967	5	4057772.5	0.0336	0.16
23	Sarson	1	1390	1440	4	6950	0.0001	0.00
24	Green pea	12	3308	2443	-26	726390	0.0060	-0.16
	Overall	955	2519	2457		120734707	1.0000	5.51

5.4. Price discovery in eNAM: As mentioned earlier, the major objective of the introduction of e-NAM across the markets in different state is to price discovery. Table 48 shows the price of the 24 agricultural commodities before and after the e-NAM implementation. The price of cotton was 4247 before e-NAM but it has increased to 5128 after e-NAM. Similarly price for paddy, jowar, tur, groundnut, soybean, fruits and vegetables have increased after implementation of e-NAM at mandies across states in India. However, rests of the price for agricultural commodities have decreased. The highest positive price difference was observed in cotton (21) followed by paddy (19) and groundnut (17). On the other side, the highest negative price difference was observed in urad (-42) followed by masur (-21) and vegetable1 (-12). Similarly the value of paddy has also increased greatly though we have not achieved much difference in agricultural commodities. Overall value of agricultural commodities also has increased after the introduction of the e-NAM.

The prices of paddy and wheat realized by the eNAM participating farmers are higher than the minimum support prices in both the years. Further comparisons with business usual scenarios using wholesale price indices are done with price differentials in eNAM to know if the latter would still be beneficial compared to the counterfactual scenarios (Table 49). While wholesale prices for most commodities during the study period displayed decline, price differentials in eNAM are positive for most crops and on the whole are five percent higher over the pre-eNAM prices received by the adopting farmers.

Table 49: Price difference comparisons between eNAM adoption and business as usual scenarios

Crop	Price differential with		
	eNAM	Business as usual scenarios	
		Wholesale price indices	Wholesale prices
Paddy	19	3	
Wheat	0	-5	-9
Jowar	3	-3	-6
Bajra	0	-13	
Maize	-3	-12	1
Tur	9	-36	-39
Gram	0	-39	-53
Masur	-21	-25	
Moong	-3	-13	
Urad	-42	-34	
Groundnut	17	-11	-16
Cotton	21	0	-3
Fruits	6	7	
Vegetables	-9	50	

Source: eNAM price differentials are calculated from field data. MSPs and wholesale prices are taken from DES

5.5. Determinants of satisfaction and price differentials in e-NAM: As mentioned in the methodology, logistic regression followed by Tobit model is used along with descriptive analysis in the study (Table 50). In the logistic regression, dummy for satisfaction with eNAM over manual mandi is used as dependent variable and other determinants considered for analysis are independent variables to examine whether performance of e-NAM is better than manual mandis (Table 50). The result shows that bidding facilities, e-auction facilities, testing of quality, overall rate of e-NAM, price discovering, online payment, cleaning facilities and price for wheat and pulses are significant, implying that e-NAM is better in these than mandis. The positive and significant level at overall rate of e-NAM shows that e-NAM is performing well as it was expected.

The Tobit model regression analysis was performed by considering price differences as the dependent variable and other determinants as independent variables to examine what are factors responsible for positive price differences in crops when farmers sell their crops after the introduction of e-NAM. In other words what helps farmers to get better price for their crops? The result of Tobit regression is more or less consistent with the result of logit model. The variables such as irrigation, test quality parameter and price discovering are positively significant in the result, implying irrigation; test quality parameter and price discovering are determining positive price difference. The negatively significant variables such as bidding facilities, e-auction facilities, higher mandis fee, sale process, poor net connectivity, grading

facilities and quality parameters shows negative returns to farmers. The positive significant north dummy shows that the performance of e-NAM is better in north region (Table 58). Example farmers from Haryana have received price discovery and also received benefits in selling their crops in e-NAM whereas this is not seen other regions of the country.

Table 50: Factors determining price differences and satisfaction with eNAM: Tobit and logit regression results

Variables	Tobit for price difference		Logit for e-NAM better than manual mandis	
	Dependent variable: Price difference		Dependent variable: e-nam better than manual mandis	
	Coefficient	Std. Error	Coefficient	Std. Error
Education in number of years	-1.54***	0.39	-	-
Educated or not	-	-	0.91	0.71
Actual land owned	-0.3	0.26	-0.03	0.04
farm size	-2.26	1.74	-	-
Irrigated area - 100% irrigated or less	9.16**	4.37	-0.45	0.68
Assaying facility available or not	4.61	4.07	-0.22	0.63
Bidding facility available or not	-8.39	5.38	1.9***	0.70
e-auction facility available or not	-6.35	4.48	1.5**	0.62
Rate test quality parameters	6.59**	2.93	-	-
Received a report on testing of quality	-	-	1.61***	0.56
Rate e-NAM overall	1.3	3.23	3.76***	0.47
Higher mandi fees than before	-8.39**	4.17	-	-
No guidance or help desk	-	-	-0.74	0.57
Electronic system does not work	-	-	-0.6	0.53
Discovering prices is cumbersome	12.76***	3.50	-1.14**	0.54
Sale process is complicated than before	-1.58	3.32	-	-
Poor net connectivity	-6.88**	2.99	-	-
Grading facilities are not adequate	-3.85	3.77	-	-
Quality parameters are stringent	-8.6**	3.83	-	-
Online payment process is difficult	-	-	-1.41**	0.55
No trained manpower to help	-	-	-0.36	0.44
Cleaning facilities are not adequate	-	-	-1.37**	0.61
No refrigeration facilities	-	-	-0.92	0.59
Dummy north	19.39***	7.08	-0.57	0.77
Dummy west	-7.7	5.61	0.53	0.69
Dummy south	-5.97	7.41	-0.93	1.00
Dummy rice	5.48	4.76	-0.91	0.70
Dummy wheat	-4.98	5.25	-1.48**	0.74
Dummy pulses	0.14	5.93	-4.22***	1.30
Dummy vegetables	-7.35	8.29	-0.71	0.83
Constant	28.96***	10.30	0.87	1.70
Sigma	24.03	1.03		
Log likelihood	-1443.5		-99.84	
Number of obs	437		537	
LR chi2(22)	168.89		514.44	
Prob > chi2	0.0000		0.0000	
Pseudo R2	0.0553		0.7204	
left censored observations at pdiff_perc2<=0	143			
uncensored observations	294			
right censored observations	0			

The results of surveyed data presented for analysis is strongly consistent with the results of secondary data analysis presented in previous chapter. Farmers across the surveyed states

have received profits in crops by selling them in higher price after the implementation of e-NAM. Besides, in terms of quality testing, cleaning, sorting, drying, grading weighing, assaying and etc, most of the farmers have responded positively. However, traders have not been benefited much as expected. Overall the impacts of e-NAM have been noticed in the study which was expected by not only researchers but also both policy makers as well as stakeholders.

6. Conclusions and policy implications: The objective of the study was to study analyse the performance of e-NAM, impact of e-NAM on stakeholders and particularly discovery of farmers' price keeping the context of doubling the farmers; income by 2022. They employed not only the secondary for analysis but also primary data in order to supplement the former analysis to robust inference. The secondary data was collected and compiled from various e-NAM mandis available with the Department of Marketing, MoA&FW, GoI and primary data was collected from six states (Uttar Pradesh, Madhya Pradesh, Haryana, Maharashtra, Telangana and Gujarat). Along with descriptive analysis, both probit and logit model were employed for the analysis.

6.1. Salient findings of the study: According to the analysis of both secondary and survey data, following major findings are recorded. Farmers across the state selected for analysis have received higher price for their crops sold after the implementation of e-NAM. Around 66 percent of farmers from across states have confessed that testing of quality parameters is transparent, while only 22 and 47 percent of farmers cast to have received a report on testing of quality and rate testing of quality parameters are alright, liberal and very liberal respectively. Around 82 per cent of respondent from Gujarat, 79 per cent from Haryana, 64 percent from Maharashtra and 89 per cent from Telangana have noticed better price and facilities for transaction cost after e-NAM. However, this is not seen Madhya Pradesh.

All most all the farmers surveyed across states have reported satisfaction with the cleaning, drying, weighing, assaying, bid management and e-auction. About 100 per cent of farmers are happy with the cleaning, sorting, drying, grading, weighing, assaying, bid management, e-auction, grain storage, soil testing and cold storage across selected states. More than 90 per cent reported to have received quality of facilities across states except Madhya Pradesh which sort fall in cleaning, sorting, drying and grading. Regarding problem faced by farmers at e-NAM, farmers have reported that there is no guidance or help desk, inadequate grading facilities, sorting facilities, poor net connectivity, labor problem in loading and uploading and

etc. The sever problems listed by them are in guidance or help desk, grading, sorting, refrigeration, testing, online payments, manpower and price discovering. Overall 86 per cent of respondents reported lack of guidance or help desk and lack of trained manpower to help with e-NAM are the major problem followed by grading, sorting, refrigeration, testing and online payments problems.

Regarding the severity of problems faced by farmers at e-NAM, overall 48 per cent of farmers have reported Labour problem for loading / unloading and 46 per cent of farmers have reported there is no trained manpower to help with e-NAM. They have also faced the severity of problem such as electronic system, complicated sale process, higher mandi fee, difficulty in online payments, poor net connectivity, absence of refrigeration facilities, collusion among traders, absence of trained manpower to help, difficulty in getting licenses, discovering prices, cleaning, sorting, grading facilities and etc.

In our analysis on advantage of e-NAM, we found that more than 50 per cent stakeholders from across states reported better facilities for knowing quality of product, higher price realization, transparent procedures and lower cost of marketing. Mostly farmers from Telangana have realized advantages of e-NAM in terms of better facilities for knowing quality of product, satisfaction of being part of the national market, higher traded volume and online payment is more convenient.

Besides getting advantage of e-NAM, farmers have also given following suggestions for better performance of e-NAM in future. Providing guidance / help at the mandi, facilities for manual sale, create or improve weighing facilities and refrigeration facilities, sorting facilities, grading facilities, sale process through e-NAM and infrastructure, increasing the use of mobile App, reduce delay in online transactions and ensure single license for the entire country are the major suggestion given by the farmers based on their experience at e-NAM.

6.2. Policy implications: In the analysis on the performance and prospects of electronic National Agricultural Market (e-NAM), farmers across the state have not only received higher price for their crops sold but also have retorted with the cleaning, sorting, drying, grading, weighing, assaying, bid management, e-auction, grain storage, soil testing and cold storage across selected states. However, they have also reported as sever problem like lack of guidance or help desk, grading, sorting, refrigeration, testing, online payments, manpower

and price discovering. Therefore, structural improvement in e-NAM is needed for better price realization and satisfaction in services given.

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Appendix

Table A1: Detailed list of *mandis* under e-NAM in selected states

Gujarat	Haryana	Madhya Pradesh	Maharashtra	Telangana	Uttar Pradesh	
Ahmedabad	Adampur	Agar	Aatpadi	Achampet	Achnera	Lalitpur
Bhabhar	Ambala	Ashoknagar	Achalpur	Adilabad	Agra	Lucknow
Bhesan	Asandh	Ashra	Aheri	Atmakur	Ajuha	Madhoganj
Bhiloda	Barwala Hisar	Badnagar	Ahmednagar	Badepally	Akbarpur	Mahmudabad
Bilimora	Bhiwani	Badnawar	Akola	Bhainsa	Aligarh	Mahoba
Botad	Ch Dadri	Balaghat	Amaravathi	Choppadandi	Allahabad	Mainpuri
Dahod	Cheeka	Bareilly	Arjuni Morgoan	Devarakadra	Auraiya	Mathura
Deesa	Chhachhrauli	Berasia	Aurangabad	Devarakonda	Azamgarh	Mauranipur
Dhanera	Dabwali	Betul	Barshi	Gadwal	Badaun	Meerut
Dhoalka	Dhand	Biaora	Basmat	Gajwel	Bahraich	Milak
Dhrol	Ellanabad	Bina	Beed	Gangadhara	Ballia	Mirzapur
Godhra	Faridabad	Burhanpur	Bhokar	Gollapally	Banda	Moradabad
Halvad	Fatehabad	Chhatarpur	Dhule	Hyderabad	Bangarmau	Muskera
Himmatnagar	Ganaur	Chhindwara	Dondaicha	Jagtial	Barabanki	Muzzaffarnagar
Jam Jodhpur	Gharaunda	Dabra	Dound	Jammikunta	Bareilly	Naanpara
Jamkhambhaliya	Gohana	Damoh	Gevrai	Jangaon	Basti	Palia Kalan
Jamnagar	Gurgaon	Datia	Hingoli	Jogipet	Bharthana	Partawal
Jasdan	Hansi	Dewas	Junnar	Kalwakurthy	Bharuasumerpur	Pilibhit
Jhalod	Hodal	Dhar	Karad	Kamareddy	Bilsi	Powayan
Junagadh	Indri	Gadarwara	Khamgaon	Karimnagar	Bindiki	Pratapgarh

Kodinar	Ismailabad	Ganj Basoda	Kolhapur	Kesamudram	Bisalpur	Puranpur
Mahuva	Jakhal	Guna	Latur	Khammam	Bulandshahar	Rae Bareli
Nizar	Jhajjar	Harda	Lonand	Mahbubnagar	Chandauli	Rampur
Patan	Jind	Indore	Malegoan	Makthal	Chandausi	Bilaspur
Pavi-Jetpur	Jullana	Itarsi	Malkapur	Metpally	Charra	Rath
Petalad	Kaithal	Jabalpur	Mangrulpeer	Miryalaguda	Chaubepur	Robertsganj
Porbandar	Kalanwali	Jaora	Mumbai	Nagarkurnool	Chibramau	Safdarganj
Rajkot	Kalayat	Karond	Nagpur	Nakrekal	Dadri Up	Saharanpur
Sanand	Karnal	Katni	Nandurbar	Narayanpet	Deoria	Sahiyapur
Savarkundla	Ladwa	Khandwa	Nasik	Narsampet	Etah	Shaganj
Savli	Madlauda	Khargone	Newasa	Nizamabad	Etawah	Shahbad Hardoi
Talod	Mullana	Khategaon	Parbhani	Peddapalli	Faizabad	Shahjahanpur
Thara	Narnaund	Khirkhya	Pimpalgaon Baswant	Sadasivpet	Farrukhabad	Shamli
Tharad	Narwana	Mahidpur	Pune	Shadnagar	Fatehpur Sikri	Shikohabad
Vadhvan	Nissing	Mandla	Rahuri	Shankarapally	Ghaziabad	Sirsaganj
Vadodara	Palwal	Mandsaur	Sangli	Siddipet	Ghiror	Sitapur
Valsad	Panipat	Mhow	Selu	Suryapeta	Golagokarnath	Sultanpur
Vijapur	Pehowa	Morena	Shirur	Tanduru	Gonda	Tikuniya
Visavadar	Pillukhera	Neemuch	Solapur	Tirumalgiri	Gorakhpur	Tundla
Visnagar	Pundri	Obaidullaganj	Tumsar	Vikarabad	Hapur	Ujhani
	Rania	Pipariya	Vaijapur	Wanaparthi Road	Hardoi	Urai
	Ratia	Ratlam	Vani	Wanaparthi Town	Hathras	Varanasi
	Rewari	Rewa	Varora	Warangal	Jahangirabad	
	Rohtak	Sagar	Wardha	Zaheerabad	Jais	
	Safidon	Sanwer	Yeola		Jalaun	
	Samalkha	Satna			Jangipura	
	Shahbad	Sehora			Jhansi	
	Sirsa	Sehore			Kaimganj	
	Siwani	Sendhwa			Kannauj	
	Sonepat	Seoni			Kanpur	
	Taraori	Shahpura Bhitoni			Kasganj	
	Thanesar	Shajapur			Khair	
	Tohana	Sheopurkalan			Khalilabad	
	Uchana	Shujalpur			Khurja	
		Tikamgarh			Konch	
		Timarni			Kopaganj	
		Ujjain			Kosikalan	
		Vidisha			Lakhimpur	