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Shaping Agricultural Market through E-Nam in India

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Abstract
The study explores the role of e-NAM (National Agriculture Market) in India's agricultural trade and financial inclusion. It uses secondary data to analyse trends in registered farmers, traders, mandis, trade volumes, and commodities. Results show strong positive correlations between registrations, trade volumes, and mandis, highlighting their collective contribution to market efficiency and financial inclusion. The study concludes that e-NAM fosters market access, streamlines trade operations, and integrates farmers and traders into formal financial systems, driving agricultural and economic progress. Recommendations include addressing implementation challenges, improving digital literacy, and expanding infrastructure.
Keywords: *E-NAM, Agricultural marketing, Financial Inclusion, Correlation, Trends.*

Introduction

An agricultural country, India depends either directly or indirectly on the agriculture industry. The Ministry of Agriculture & Farmers Welfare and(Chaudhari and Anute). Highlights that India is the second-largest producer of fruits, vegetables, and food grains worldwide. For growth of agricultural sector government takes various initiatives, such as the E-Naam scheme, farmers in the countryside may obtain financial empowerment through increased use of online platform (Nwuba and Nwaizugbo) and its helpful to promote farmers' welfare and financial inclusion. Financial inclusion for the agricultural sector have significantly increased in recent years, aimed at strengthening and improving agricultural practices, uses internet platforms for trade and profitable operations in the era of digitalization, which boosts the Indian economy. The period of time when technology is used for all activities (Ningsih, Rasyid and Natali) IN Agriculture it is used for marketing of agricultural products, Agricultural marketing plays a major role (Nwuba and Nwaizugbo) to increase in the production and marketable surplus of major agricultural commodities, better income levels (Shalendra) For knowing agricultural marketing in this study researcher used E Nam platform. India's National Agriculture Market, also referred to as E-Nam, is an online marketplace for agricultural goods that was founded on April 14, 2016. Market allows farmers, buyers, and sellers to trade goods online. The market provides possibilities for effective product marketing and helps determine prices more accurately (Chaudhari and Anute) e-National Agriculture Market (e-NAM) was envisaged as Pan India electronic trading portal which seeks to network the existing APMC, to sell the agricultural produce only at designated regulated markets (mandis) through registered intermediaries governed by the Agricultural Produce Market Committee (APMC) (Kumar, Kumar and PC)& other market yards to create a united national market for agriculture commodities (Department)

One of the major role played by financial inclusion, by reflecting positive trends, correlations and significant insights in economic activities driven by improved access to financial systems. The growth in Mandis (markets) suggests the expansion of financial inclusion. The steady rise in registered trades indicates that more individuals and businesses are gaining access to formal financial systems, such as bank accounts, credit, and digital payment platforms, integrating them into the regulated financial network. Similarly, the increase in total trade volume highlights greater financial activity, which are often facilitated by access to credit, digital payments, and financial literacy.

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Together, these trends and correlation demonstrate the impact of financial inclusion initiatives in reducing poverty, boosting entrepreneurship, and empowering populations related traders and farmers to engage in the economy.

Agri marketing:

(Shakeel and BODDU) and (D. A. Kumar) India's agriculture sector has traditionally been seen as the backbone of its economy. More than 58% of India's population depends on the agricultural sector, and recent developments in both agriculture and the economy have brought attention to how vital marketing is to the general well-being and growth of farmers. In 2003, market reforms were implemented in agricultural marketing to improve market efficiency, competitiveness, transparency, and private player participation and to take advantage of the shifting global trade landscape. (Shalendra) according to the Indian Council of Agricultural Research Assembling, processing, and distribution are the three most crucial aspects of agricultural marketing. (Nwuba and Nwaizugbo; Nwuba and Nwaizugbo) Enhancing the performance of the, boosting farmers markets, building infrastructure, encouraging online trading, and setting up local outlets during the pandemic are some of the measures the government has taken to improve the agricultural market (Parimalarangan and Baskar) Purchasing, collecting, grading, storing, processing food, transporting, financing, and selling agricultural products are all processes that fall under the umbrella of agricultural marketing. (Kumar, Kumar and PC) The transportation of agricultural products from farmers to consumers is handled by a number of services that make up the agricultural marketing system. (Shalendra)

Enam:

For uniformity and information reduction, e-NAM was adopted in the Union Budget 2014–15.((Dr. Sathyendra Kumar A D and Pant) It has a farmers database, gate entrance, mobile payments, HIM, and MIS dashboard. (Chaudhari and Anute)In order to promote e-trading measures, evaluate state APMC Acts, and ensure prompt payments and transparent transactions, APMCs ought to use an online platform.. (Dr. Sathyendra Kumar A D and Pant) Enhancing consistency, streamlining processes, removing information asymmetry, facilitating real-time price discovery, improving auction transparency, and offering a national farmer market are all goals of the e-NAM. (Kumar, Kumar and PC) The Department of Marketing, MoA&FW, and GoI uses market arrivals and offers gathered by different e-NAM mandis to examine market patterns (Nuthalapati, Bhatt and Beero). Additionally, since both farmers and traders utilize online platforms, they are all part of the financial inclusion effort.on eNAM platform, registered farmers, traders, and mandis contribute to improving market access and promoting financial inclusion.

Review of Previous Studies:

Agricultural marketing plays a vital role in ensuring the profitability and sustainability of farming practices worldwide, and various studies highlight the factors influencing its dynamic. In Anambra State, Nigeria, key determinants of farmer's profits include product types, production location, pricing strategies, and promotional efforts, while barriers like middlemen, inadequate infrastructure, and lack of market information persist (Nwuba and Nwaizugbo). Similarly, (Hans, Govindaswamy and Udupi) studies emphasize the critical challenges faced by farmers, such as poor infrastructure, price volatility, and limited market access. Recommendations to overcome these include digital platforms, regulatory reforms, and enhanced training in digital literacy. The adoption of digital technologies has the potential to transform agricultural marketing. Platforms like Napanta and the Uzhavan app in India illustrate the benefits of digital marketing strategies in improving market accessibility, reducing costs, and enhancing supply chain efficiency (Chaudhari and Anute). These developments align with the broader trend of integrating sensors, drones, and blockchain to empower smallholder farmers by improving real-time data collection and access to global value chains. However, challenges such as power imbalances and restricted access necessitate policies that protect farmers' rights and ensure equitable benefit distribution (Kos and Kloppenburg). Digital agricultural advisory services and extension systems have also been recognized as transformative tools for enhancing smallholder productivity and empowerment. While digital solutions offer significant promise, barriers like low digital literacy, expensive internet, and infrastructure deficiencies remain key obstacles. Investments in infrastructure and education from governments, corporations, and extension agencies are thus critical ((AGDR)).

In India, initiatives like e-NAM (National Agriculture Market) reflect the growing significance of digital integration in agriculture. This online trading platform connects agricultural mandis, aiming to improve farmers technical skills, address information asymmetry, and promote cashless transactions. Studies on e-NAM highlight its positive social, psychological, and employment-related outcomes (AS, Deshmukh and Kadam). Additionally, the need for improved harvesting practices, storage facilities, and direct marketing is crucial to empowering smallholder farmers and reducing post-harvest losses (Nedumarana, Aravazhi and Nandi). Policy initiatives such as those aimed at doubling Indian farmers' incomes by 2022 underline the urgency of marketing reforms to make agriculture sustainable and competitive. By addressing issues like middlemen, transportation, and split market knowledge, these reforms can alleviate rural poverty and food insecurity while strengthening supply chains disrupted by events like the COVID-19 pandemic (Dr. Sathyendra Kumar A D and Pant). The integration of Information and Communication Technologies (ICT) into agricultural systems can further enhance farmers' market information and access, thereby improving national food security and profitability. Successful marketing channels depend on collaboration among farmers, processors, and merchants (Kumaravel, Leonard and S) these findings collectively underscore the transformative potential of technology and regulatory reforms in addressing long-standing challenges in agricultural marketing across diverse regions.

The paper highlights, in e-NAM's impact on farmers, particularly in remote regions, and the inadequacy of participation data. It also emphasizes the need for a deeper understanding of local contexts and external factors affecting its effectiveness. The study also emphasizes the need for assessing digital literacy among farmers and traders and longitudinal studies to evaluate the long-term effects of e-NAM on agricultural marketing and financial inclusion. Addressing these gaps could significantly improve the understanding and effectiveness of agricultural marketing systems in India.

Research problem:

In spite of efforts to modernise agricultural marketing systems, challenges such as limited market access, low financial inclusion, and inadequate participation of farmers, traders, and mandis persist. By January 2018, 36,200 crore transactions had been made through India's National Agriculture Market (E-Nam), which facilitates the online selling of more than 90 agricultural products. Free interstate trade, accelerated processes, and the elimination of information asymmetry are all made possible by real-time price discovery in supply and demand (Dr. Sathyendra Kumar A D and Pant) .

While digital and policy interferences have aimed to rationalize agricultural trade and empower stakeholders, the extent to which the registration of farmers, traders, and mandis influences agricultural trade volume, market access, and financial inclusion remains underexplored

Objectives:

1. To analyse trends in the registration of farmers, traders, and mandis and their impact on agricultural trade over time.
2. It aims to explore the correlations between these substances and agricultural trade volume.

Methodology:

This study utilises a correlational research design to analyse trends and relationships within e-NAM data from 2020 to 2024. The research focuses on examining the trend in registered farmers, traders, mandis, states, UTs, trade volumes, and commodities over the five-year period. Secondary data serves as the basis for this analysis, with key variables including the total number of registered farmers and traders (in millions), the number of mandis, participating states and UTs, total trade volumes (in million metric tonnes), and the number of commodities traded. In the implementation of statistical tests, such as descriptive statistics, correlation, and trend (Kanellos, Panagiotis and Nikolaos)the trend analysis aims to evaluate yearly changes in these variables using line charts to visualise growth patterns. A correlation analysis will examine the relationships between key variables such as registrations (farmers and traders) and trade volumes, as well as the number of mandis and trade volumes. Statistical tools such as Excel will be employed to perform descriptive statistics, correlation analysis, and regression modelling.

The interpretation will focus on analysing the strength of correlations and evaluating the impact of increased participation on trade efficiency and market access. The expected outcomes include insights into trends, evidence of relationships among variables, and an assessment of how e-NAM contributes to improving agricultural trade and financial inclusion.

Results and Discussion:

1. Descriptive Statistics:

Provide a foundational understanding of the data and its characteristics herewith, researcher analyse the statistical tests, like descriptive statistics (Kanellos, Panagiotis and Nikolaos), dataset provides comprehensive insights into various aspects of agricultural and trade metrics, revealing interconnections between registered farmers, trades, mandis, states, union territories (UTs), total trade volume, and commoditie.

The mean number of registered farmers (1.718) and registered trades (1.932) indicate consistent averages with minimal variability, as reflected by their low standard deviations (0.044 and 0.541, respectively). The relatively kurtosis values of registered farmers and trades are -1.464 and -2.591 and slight skewness highlight a balanced spread of these metrics, suggesting uniform participation across farmers and trades. The average number of mandis (1150), although significantly larger, shows significant variability (standard deviation of 205.63), implying that mandis serve as centers for the agricultural economy, connecting a large number of farmers and trades.

Table 1: registered Trades	
Mean	1.93
Standard Error	0.24
Median	1.82
Standard Deviation	0.54
Sample Variance	0.29
Kurtosis	-2.59
Skewness	0.14
Range	1.22
Minimum	1.31
Maximum	2.53
Sum	9.66

Table 2: Total no fo registered Farmers	
Mean	1.71
Standard Error	0.01
Median	1.72
Standard Deviation	0.04
Sample Variance	0.001
Kurtosis	-1.46
Skewness	-0.2
Range	0.11
Minimum	1.66
Maximum	1.77
Sum	8.59

Table 3: Mandis	
Mean	1150
Standard Error	91.96
Median	1000
Standard Deviation	205.63
Sample Variance	42285.5
Kurtosis	-3.27
Skewness	0.61
Range	389
Minimum	1000
Maximum	1389
Sum	5750

Table 4: States	
Mean	20
Standard Error	1.22
Median	18
Standard Deviation	2.73
Sample Variance	7.5
Kurtosis	-3.33
Skewness	0.608
Range	5
Minimum	18
Maximum	23
Sum	100

Table 5: total volume Trade	
Mean	6.038
Standard Error	1.06
Median	5.7
Standard Deviation	2.38
Sample Variance	5.7
Kurtosis	-2.38
Skewness	0.22
Range	5.53
Minimum	3.43
Maximum	8.96
Sum	30.19

Table 6: commodities	
Mean	206.8
Standard Error	14.2
Median	221
Standard Deviation	31.75
Sample Variance	1008.2
Kurtosis	5
Skewness	-2.23
Range	71
Minimum	150
Maximum	221
Sum	1034

Table 7: UTs	
Mean	3.4
Standard Error	0.24
Median	3
Standard Deviation	0.54
Sample Variance	0.3
Kurtosis	-3.33
Skewness	0.6
Range	1
Minimum	3
Maximum	4
Sum	17

Source: Author calculations

Similarly, the average number of states (20) and UTs (3.4) involved in these activities reflects the geographic diversity of participation on one platform (Kumar, Kumar and PC). The total trade volume (mean of 6.038) and commodities (mean of 206.8) further interlink the agricultural network. Collectively, these metrics highlight a well-connected agricultural and trade system,

where registered entities, Mandies, and trade volumes are interdependent and contribute to shaping the dynamics of agricultural markets.

2. Correlation Matrix:

H1: There is a significant correlation between the registration of farmers, traders, and mandis and agricultural trade volume. Hypotheses were tested using Principal Component and Regression Analysis. Regression (Nwuba and Nwaizugbo) The correlation matrix provides valuable insights into the relationships between various variables in the dataset, illustrating the degree to which they are interconnected. A strong positive correlation (close to 1) is observed between *registered farmers* and *registered traders* (0.981), indicating that an increase in the number of registered farmers is closely tied to a rise in registered traders. Similarly, *mandis* exhibit a strong correlation with both *registered trades* (0.943) and *states* (0.999), emphasising their important role in agricultural trade and distribution across regions.

Table 8: Correlation Matrix

	Total no fo registered Farmers	registered Trades	Mandis	States	UTs	total volume Trade	commodities
Total no fo registered Farmers	1						
registered Trades	0.98	1					
Mandis	0.87	0.94	1				
States	0.86	0.94	0.99	1			
UTs	0.86	0.94	0.99	1	1		
total volume Trade	0.98	0.99	0.93	0.92	0.92	1	
commodities	0.73	0.64	0.4	0.4	0.4	0.61	1

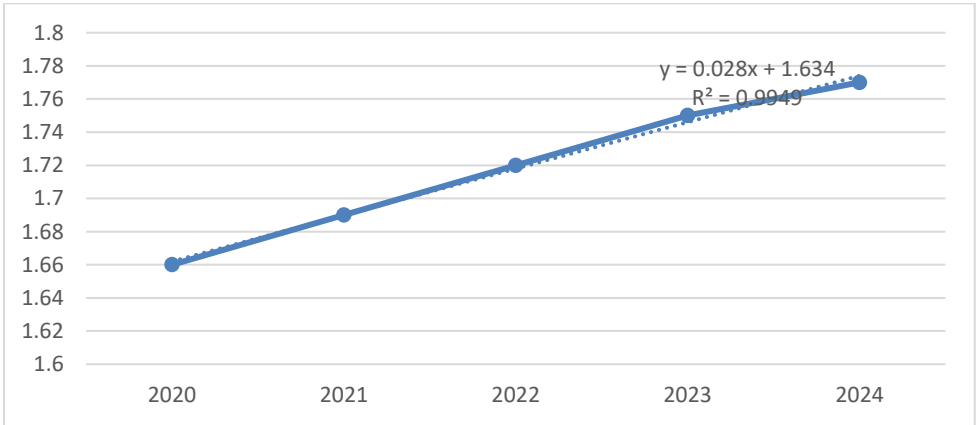
Source: Author calculation

With the highest correlation being with *registered farmers* (0.730). Finally, *total trade volume* shows very strong correlations with both *registered trades* (0.993) and *registered farmers* (0.985), signifying that trade volume is mostly obsessed by farmer participation and trade registrations. Overall, the data highlights a closely interconnected network, thus the researcher is accepting the alternative hypothesis and rejecting the null hypothesis where registered farmers, trades, mandis, and regions (states and UTs) collectively shape trade volumes.

3 Trend Analysis:

Trend analysis is a vital tool in research and decision-making because it helps to identify patterns, relationships, and changes over time. The data shows a consistent and steady increase in registrations, as represented by the upward linear trend. The equation of the trendline, y=0.028x+1.634, indicates that the number of registered farmers grows at an average rate of 0.028 million per year, starting from an initial value of approximately 1.634 million in the first year. The R^2 value of 0.9949 signifies a very strong fit of the linear model to the data.

Figure 1: Total number of registered Farmers



The graphs show upward trends across all metrics. Figures 2,3, and 4 show a moderate increase, with a trendline equation y=113.9x+808.3 and an R^2 value of 0.767, indicating a moderately strong fit. The Registered Trades graph reflects steady growth from 2020 to 2024, with a trendline y=0.334x+0.93 and a high R^2 of 0.9524, indicating strong reliability. Similarly, the Total Volume Trade graph demonstrates robust growth during the same period, with a trendline y=1.49x+1.568 and a very high R^2 of 0.9726, suggesting excellent predictability.

Overall, all metrics indicate consistent upward trends, with varying degrees of correlation strength. Results suggest that accept the alternative hypothesis i.e. a significant trend in the registration of farmers, traders, mandis and trade volume over time.

Major Conclusions and Policy Suggestions:

In conclusion, this study highlights the strong connections and trends in agricultural and trade activities, offering valuable insights into agricultural marketing. It shows how registered farmers, traders, mandis, states, UTs, trade volumes, and commodities work together to shape market growth. The data reveals consistent participation by farmers and traders, with mandis playing a key role in linking stakeholders across regions. High correlations between trade volumes, farmer registrations, and traders confirm their interconnected growth. Trend analysis shows steady increases in all metrics, reflecting a significant and

expanding agricultural network. The findings also emphasise the importance of financial inclusion, as improved access to credit and digital payments has empowered farmers and traders, boosting market activity and economic progress.

This study confirms that these networks drive agricultural trade and financial inclusion, providing a strong basis for policies to enhance efficiency and participation in agricultural markets.

The study suggests several key policy recommendations to enhance the effectiveness of e-NAM and improve agricultural marketing systems in India:

1. E-NAM Implementation Guidelines: Standardize implementation across regions to ensure consistency and effectiveness. Engage local stakeholders to adapt guidelines effectively.
2. Improve Data Collection and Analysis: Establish robust mechanisms for collecting and analysing farmer registrations, participation rates, and trade volumes. also Identify and address gaps in participation, especially in remote areas.
3. Promote Financial Inclusion Initiatives: Encourage financial institutions to create personalized financial products for farmers using e-NAM. And Offer microloans and insurance products to enhance financial inclusion and elasticity.

Limitations and Future Scope:

The study on agricultural marketing platforms like e-NAM faces several limitations that impact its broader applicability. Relying on secondary data from e-NAM may not fully capture the diversity of agricultural regions or provide a comprehensive understanding of market dynamics. Its temporal scope (2020-2024) risks overlooking long-term trends and cyclical variations crucial for assessing sustainability.

While Future research on e-NAM and agricultural marketing presents numerous opportunities to enhance the platform's effectiveness and address existing challenges. Advanced data analytics using artificial intelligence and machine learning could be employed to analyse trade volumes, commodities, and farmer-trader interactions on e-NAM, enabling predictive

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Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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Appendix:

Figure 2: Registered Traders

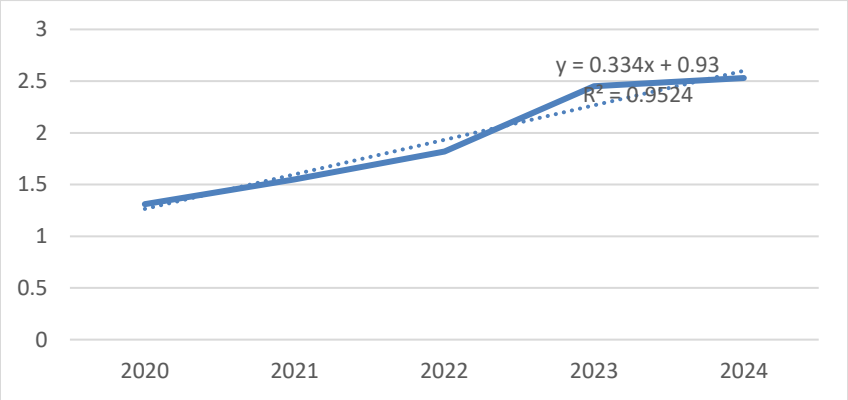

Figure 3: Total Volume Trade

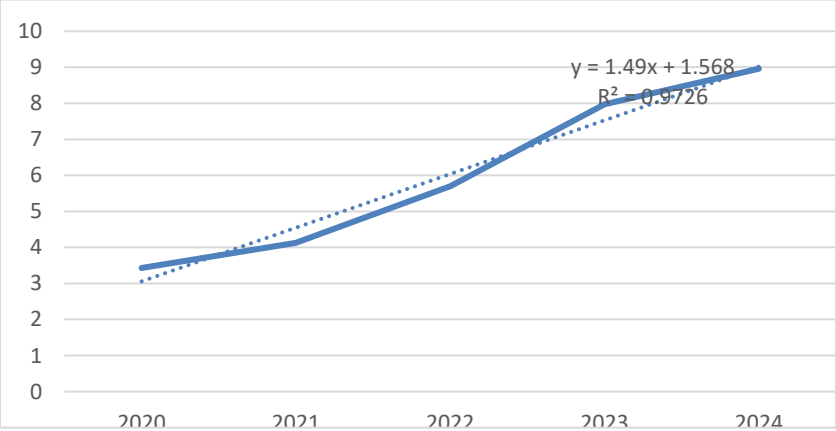

Figure 4: Mandis