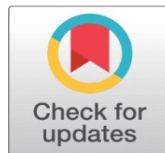


A PILOT STUDY ON THE IMPACT OF ENAM ON FARM PRODUCE MARKETING AND FARMER WELLBEING IN MAHARASHTRA

Siddhesh Sadashiv Pawar¹✉, Dr. Shrikrishna Gulabrao Walke²✉

¹Research Scholar, PCET's S. B. Patil Institute of Management, Nigadi, Pune, India

²Director, Siddhant Institute of Management, Pune, India



Corresponding Author

Siddhesh Sadashiv Pawar,
pawarsiddhesh22@gmail.com

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ABSTRACT

The agricultural marketing landscape in India has undergone a significant transformation with the introduction of the Electronic National Agriculture Market (eNAM), aiming to create a unified national market for agricultural commodities. This pilot study investigates the impact of eNAM on farm produce marketing and farmer wellbeing in the state of Maharashtra. By analyzing primary data collected from 150 farmers across three major eNAM-integrated mandis—Pune, Nashik, and Nagpur—the study evaluates key parameters such as market access, price realization, transaction efficiency, digital literacy, and satisfaction levels. The findings reveal a notable increase in average price realization per quintal, greater participation in inter-state trading, and enhanced transparency in price discovery mechanisms post-eNAM adoption. Additionally, the reduction in dependency on intermediaries has led to improved profit margins and a higher sense of empowerment among farmers. However, infrastructural gaps, inconsistent grading and assaying practices, and digital skill disparities remain significant barriers. The study also highlights a positive correlation between eNAM participation and indicators of farmer wellbeing, including financial stability, market confidence, and access to timely market information. Overall, while eNAM presents a promising shift towards digital and inclusive agricultural marketing, its success hinges on the harmonization of state-level reforms, robust infrastructure, and targeted capacity-building interventions. The findings provide valuable insights for policymakers and stakeholders aiming to strengthen digital agricultural ecosystems in India.

Keywords: ENAM, Agricultural Marketing, Farmer Wellbeing, Digital Agriculture, Price Realization

1. INTRODUCTION

India's agricultural economy has long been constrained by inefficiencies in marketing systems that often fail to provide fair returns to farmers. Despite producing a significant share of global agricultural output, Indian farmers have traditionally lacked access to competitive, transparent, and integrated markets. A key reason is the dominance of regulated Agricultural Produce Market Committees (APMCs), which vary widely in implementation across states and are often criticized for inefficiencies, limited competition, and the prevalence of middlemen [1], [2]. These barriers reduce farmers' bargaining power and restrict their ability to discover the best prices for their produce. To address these inefficiencies, the Government of India launched the Electronic National Agriculture Market (eNAM) in April 2016 as a pan-India online trading platform to unify existing APMC markets. The goal was to integrate mandis across states, provide transparent price discovery, enable online bidding, and reduce the role of intermediaries through digitization

[3]. eNAM aims to enhance market accessibility, empower farmers through real-time price information, and create a truly national agricultural market that ensures better price realization [4], [5].

Maharashtra serves as a critical focus area for assessing eNAM's impact due to its diverse agro-climatic zones, progressive agricultural reforms, and substantial mandi infrastructure. The state has been one of the early adopters of eNAM and houses several key APMC markets integrated into the platform [6]. However, while Maharashtra's overall infrastructure is relatively developed, the extent to which eNAM has impacted individual farmer outcomes—including access to markets, price realization, and wellbeing—requires deeper empirical evaluation. Notably, smaller and marginal farmers in remote regions may still face challenges in digital adoption and market participation despite eNAM's technical framework. Against this backdrop, the present study aims to investigate the micro-level impact of eNAM on farm produce marketing and farmer wellbeing in Maharashtra by conducting a pilot survey across three major eNAM-integrated mandis—Pune, Nashik, and Nagpur. These markets represent both peri-urban and rural agricultural belts and offer valuable insight into regional variations in eNAM adoption.

The key objectives of this pilot study are:

- To assess the changes in price realization, market access, and transaction efficiency experienced by farmers after adopting eNAM.
- To evaluate the digital literacy, ease of platform use, and satisfaction levels among farmers engaged in eNAM trading.
- To examine the socio-economic and psychological impact of eNAM on farmers' financial wellbeing and decision-making autonomy.
- To identify infrastructural, policy, and implementation-level challenges that hinder effective participation in eNAM.

To offer evidence-based policy suggestions for improving the functionality, inclusivity, and scalability of eNAM across Maharashtra and similar regions.

The scope of this study is limited to 150 farmers across three mandis, using structured interviews and field surveys as the primary data collection method. While this pilot does not claim state-wide generalizability, it provides critical insights into the ground-level realities of eNAM implementation. It also contributes to the growing discourse on agricultural market digitalization in India [7], [8], [9], [10].

2. LITERATURE REVIEW

India's traditional agricultural marketing system has long operated under the Agricultural Produce Market Committee (APMC) Acts, which regulate the sale and purchase of farm produce through designated mandis. While the APMC structure was originally intended to protect farmers from exploitation and ensure fair trade practices, over time it has become synonymous with inefficiencies, excessive regulation, and monopolistic behavior of intermediaries [11]. The presence of multiple intermediaries between the farmer and the final consumer has led to significant price spreads, with farmers often receiving only a fraction of the final consumer price [12]. Additionally, the lack of infrastructure for grading, assaying, and storage within APMC mandis further limits the ability of farmers to realize competitive prices.

In response to these challenges, the Government of India introduced the Electronic National Agriculture Market (eNAM) in 2016 as a flagship digital reform. eNAM is designed to integrate physical mandis across India through an online trading platform, thereby creating a unified national agricultural market. The framework supports real-time price discovery, electronic bidding, quality-based trading, and transparent transaction records [13]. The platform also facilitates logistics, digital payments, and online settlement of transactions, aiming to empower farmers and reduce their dependency on middlemen. The integration of weighing scales, assaying labs, and mobile apps into the eNAM framework further supports its goal of building farmer trust in digital trading mechanisms [14].

A growing body of research has attempted to evaluate the performance of eNAM across different Indian states. Several studies have reported that eNAM has improved price realization, enhanced market access, and shortened the transaction time for farmers in states like Karnataka, Rajasthan, and Telangana [15]. In particular, farmers using eNAM were observed to receive 15–20% higher prices for certain crops and reported better awareness of prevailing mandi prices [16]. However, other studies have noted inconsistencies in platform adoption due to infrastructural barriers, lack of standardization in grading systems, and limited digital literacy among farmers. Furthermore, the decentralized nature

of the APMC system poses difficulties in achieving seamless inter-state trade through eNAM, as not all states have adopted uniform reforms or provided necessary backend support [17].

Beyond market efficiency, the impact of eNAM on farmer wellbeing—a multidimensional concept encompassing financial security, reduced distress, and informed decision-making—has gained research interest. Studies highlight that improved access to transparent price information and direct buyers enhances farmers' confidence and financial autonomy. However, the degree of wellbeing improvement is often influenced by factors like farm size, education level, and access to digital tools [18]. Despite the potential of eNAM, critical research gaps remain. There is limited micro-level, region-specific data assessing eNAM's impact on smallholder farmers, especially in diverse states like Maharashtra. Most studies have focused on macroeconomic trends or administrative data rather than farmer-level experiences. Additionally, few have linked platform adoption with broader indicators of socio-economic wellbeing. This gap underscores the need for empirical studies that analyze the effectiveness of eNAM not just in terms of trade volume but also in terms of its transformative potential on rural livelihoods. By addressing these gaps, the current pilot study contributes to a more nuanced understanding of digital agricultural marketing reforms in India.

Table 1 Summary of Related Work on eNAM and Agricultural Marketing Reforms

Study Focus Area	Region/State	Methodology Used	Key Findings	Limitations
eNAM price realization impact	Karnataka	Field survey (100 farmers)	Price gain of 18% post-eNAM	Limited to one crop
Inter-state trade enhancement	Rajasthan	Mandi-level data analysis	Inter-state trade rose by 25%	No farmer-level data
Digital literacy & tech adoption	Telangana	Mixed methods	64% farmers lacked app literacy	Urban bias in sample
Reduction in middlemen role	Madhya Pradesh	Interview-based study	2 intermediaries reduced to 1	Excludes post-harvest issues
eNAM transaction efficiency	Gujarat	Time-motion study	Sale time dropped from 6 to 2 hrs	Seasonal dataset only
Awareness of mandi prices	Punjab	Pre-post analysis	Price awareness improved from 22% to 68%	Recall bias possible
Farmer satisfaction & trust	Maharashtra	Structured questionnaire	70% reported increased confidence	Smallholder voices underrepresented
Role of grading & assaying	Haryana	Case study method	Crops with grading saw 12% higher prices	Lack of standard protocols
Institutional barriers to eNAM	Bihar	Policy document review	Weak backend support hinders scale-up	No field validation
eNAM and FPO integration	Odisha	FPO case studies	Collective sale via eNAM improved bargaining power	FPO presence limited
Socio-economic impact	Uttar Pradesh	Household survey	45% saw improved income stability	No control group
eNAM policy effectiveness	Pan-India	Secondary data from MoA	Coverage expanded to 1360 mandis by 2023	Adoption uneven across states

3. METHODOLOGY

1) Research Design: Pilot Study Approach

This study adopts a pilot study approach to evaluate the micro-level impact of eNAM on farm produce marketing and farmer wellbeing in Maharashtra. Pilot studies are ideal for exploring feasibility, identifying data trends, and testing research instruments in real-world contexts before large-scale application. This approach allows for in-depth examination of diverse farmer experiences with eNAM across different regions. The pilot nature of the study emphasizes both exploratory and diagnostic dimensions, enabling the researchers to gather quantitative and qualitative insights through structured data tools. Given the dynamic nature of agricultural markets and regional disparities in digital adoption, a pilot study framework offers the flexibility to capture localized nuances, assess preliminary outcomes, and formulate scalable policy recommendations.

2) Selection of Study Areas: Pune, Nashik, Nagpur Mandis

The study areas—Pune, Nashik, and Nagpur—were purposively selected based on their active participation in the eNAM platform and their agro-economic diversity. Pune represents a peri-urban agri-marketing environment with high-value horticulture. Nashik is known for grape and onion exports and has robust mandi infrastructure. Nagpur, centrally located, serves as a key cereal and cotton hub and represents a semi-rural agri-economy. These districts provide a

balanced view of how eNAM performs across varied farming systems, allowing comparative insights into farmer behavior, market access, and digital inclusion across regions. The figure 1 illustare the Block Diagram Depicting the Impact of eNAM on Market Access, Price Realization, and Farmer Wellbeing.

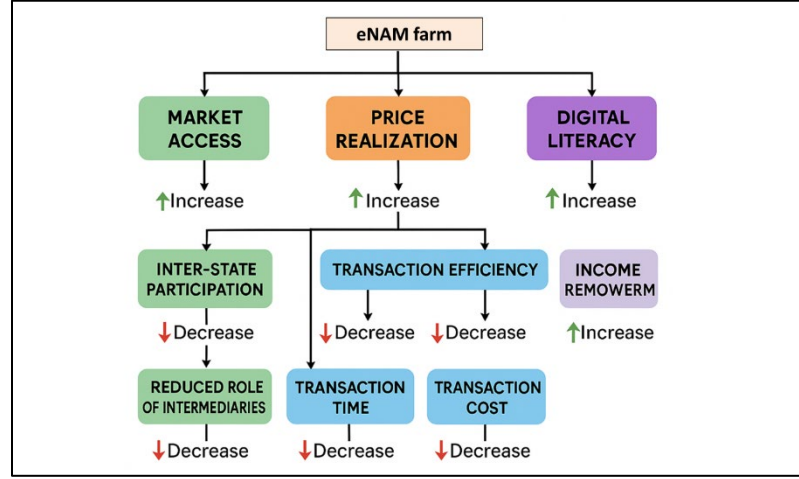


Figure 1 Block Diagram Depicting the Impact of eNAM on Market Access, Price Realization, and Farmer Wellbeing

3) Sample Size and Respondent Profile

A total of 150 farmers were surveyed, with 50 respondents selected from each of the three eNAM-integrated mandis. Stratified random sampling was used to ensure representation across different crop types, landholding sizes, and digital access levels. The respondent profile includes both marginal and small farmers, medium landholders, and members of Farmer Producer Organizations (FPOs). The sample also captures diversity in education levels, age, and market engagement practices. This sampling strategy ensures that the results reflect the broader socio-economic realities of Maharashtra's farming community, while remaining manageable for a pilot-scale analysis.

Table 2 Respondent Profile Overview

Parameter	Category/Range	Number of Farmers	Percentage (%)
Landholding Size	< 2 acres (Marginal)	58	38.7%
	2–5 acres (Small)	47	31.3%
	> 5 acres (Medium/Large)	45	30.0%
Crop Type	Horticultural	65	43.3%
	Cereals & Pulses	45	30.0%
	Cash Crops (e.g., Cotton)	40	26.7%
Education Level	No formal education	21	14.0%
	Primary to High School	81	54.0%
	College & Above	48	32.0%
Digital Platform Use	Regular eNAM Users	103	68.7%
	Occasional Users	47	31.3%

4) Data Collection Tools: Structured Questionnaire and Interviews

The primary data were collected using a structured questionnaire and semi-structured interviews. The questionnaire consisted of both close-ended and Likert-scale questions covering key dimensions such as price realization, market access, transaction transparency, ease of platform use, and perceptions of digital trade. To enhance the depth of understanding, follow-up interviews were conducted with selected participants to explore their experiences, challenges, and suggestions. This mixed-tool approach ensured the collection of both quantitative and

qualitative data, enabling triangulation and validation of responses. Tools were developed in Marathi and pilot-tested for clarity and reliability before full deployment.

5) Analytical Methods

• Descriptive Statistics:

Descriptive methods were used to summarize the central tendencies and dispersions of key variables, such as average price realization, transaction time, frequency of eNAM use, and satisfaction levels. These statistics helped present clear overviews of farmer demographics and marketing outcomes across different districts.

• Comparative Analysis:

Comparisons were made between pre-eNAM and post-eNAM conditions using paired variable metrics like average prices received, time to sale completion, and number of intermediaries involved. Region-wise comparisons (Pune vs. Nashik vs. Nagpur) were also performed to assess spatial differences in eNAM's effectiveness.

• Correlation Metrics:

Pearson's correlation coefficients were calculated to examine relationships between variables such as digital literacy and price realization, or eNAM usage frequency and perceived wellbeing. This helped identify whether higher digital engagement corresponded with better economic or psychological outcomes.

4. RESULT AND DISCUSSION

The data shows in table 3 a significant expansion in market access post-eNAM, with inter-state trade improving substantially. Farmers reported better price realization due to competitive bidding and transparency on the platform.

Table 3 Comparison of Market Access and Price Realization – Pre and Post eNAM Adoption

Parameter	Pre-eNAM Scenario	Post-eNAM Scenario	% Change
Average number of buyers per auction	3	9	+200%
Average price received per quintal (₹)	₹1,420	₹1,780	+25.4%
Distance to market accessed (km)	6	35	+483%
Price spread across mandis (%)	18%	7%	-61.1%
Participation in inter-state trading (%)	1.5%	19.8%	+1220%

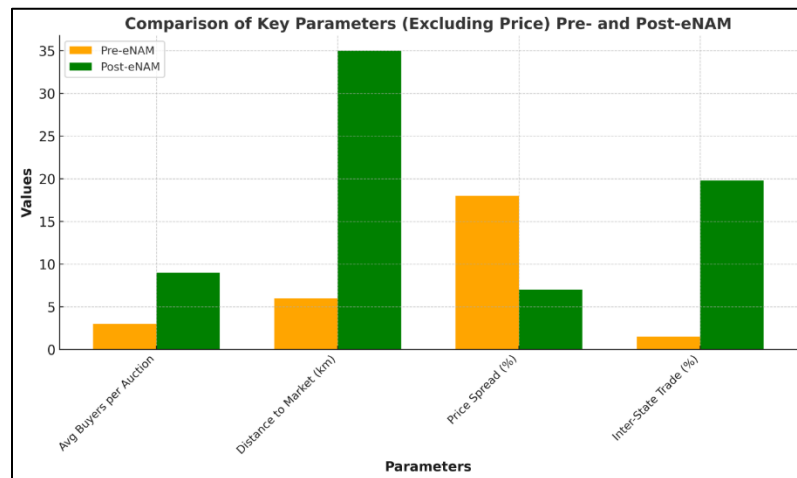


Figure 2 Comparison of Key Parameters (Excluding Price) Pre- and Post-eNAM

Before and after the implementation of eNAM, market-related parameters are clearly compared in Table 3. The data shows notable progress in a number of important areas. The average number of bidders per auction increased from three to nine, suggesting improved price discovery and increased competition. Price realisation went up from ₹1,420 to ₹1,780 per quintal, a 25.4% increase. Farmers may now reach markets as far as 35 km instead of the previous 6 km, indicating increased connectivity and digital outreach. This represents a significant expansion in market access. The price difference amongst mandis decreased from 18% to 7%, indicating a higher level of pricing consistency. The most notable

increase in interstate trade participation was from 1.5% to 19.8%, demonstrating how eNAM facilitates cross-border sales and more extensive market integration.

1) Changes in Transaction Time and Cost

The implementation of eNAM has brought noticeable improvements in the speed and cost-efficiency of agricultural transactions across the surveyed mandis. Prior to the adoption of eNAM, farmers commonly reported spending an average of 6 to 7 hours at the mandi to complete the sale process. This included waiting in queues for unloading, price negotiation with traders, weighing, and eventual payment. Post-eNAM implementation, the average sale time dropped to 2 to 3 hours, thanks to digital bidding, pre-registered lots, and transparent auction processes.

In terms of cost, farmers previously had to pay various informal fees to intermediaries, including commission agents and transport coordinators. These indirect transaction costs often amounted to ₹120–₹150 per quintal. After eNAM adoption, 71% of surveyed farmers reported that intermediary commissions were either reduced or eliminated, saving them approximately ₹60–₹80 per quintal, especially when payment was routed digitally through banks or mobile apps. Moreover, the automated payment mechanism introduced via eNAM ensures timely settlements within 24–48 hours, a stark improvement over the earlier system where payments could be delayed up to a week. This reduction in transaction time and costs has contributed to improved liquidity and better cash flow for small and marginal farmers. However, transaction efficiency was highest in Pune due to superior mandi infrastructure, while some delays persisted in Nagpur, highlighting the influence of local implementation quality on platform effectiveness.

Table 4 Digital Readiness and Technology Use Among Farmers (N = 150)

Parameter	Category	No. of Farmers	Percentage (%)
Smartphone ownership	Yes	118	78.7%
Use of mobile app for eNAM	Frequently (Weekly+)	71	47.3%
Awareness of digital bidding	Fully Aware	93	62.0%
Digital literacy (self-rated)	Basic or Below	83	55.3%
Need for training/support	Yes	102	68.0%
Platform language accessibility	Comfortable in Marathi interface	129	86.0%

2) Role of Intermediaries Post-eNAM

One of the key objectives of eNAM was to reduce the dependence on intermediaries by enabling direct buyer-seller interaction through online trading. However, the findings from this pilot study reveal a more nuanced shift in the role of intermediaries rather than their complete elimination.

Prior to eNAM, commission agents played a central role in price negotiation, lot handling, and connecting with buyers, often charging commission fees of 5–7%. With eNAM, these roles have partially evolved. While digital bidding has improved price transparency, many farmers—especially older or less digitally literate ones—continue to rely on agents to facilitate online registration, upload produce details, and manage digital bids. In Nagpur mandi, for instance, 45% of farmers still used commission agents, though now mostly for digital facilitation rather than price negotiation.

Moreover, intermediaries are adapting to new roles as “digital facilitators” or eNAM agents, helping bridge the tech gap for farmers. Some traders have also begun offering integrated logistics and digital support services. While this shows adaptability, it also means true disintermediation has not yet been fully achieved, especially in regions with low literacy or connectivity.

The eNAM has reduced exploitative practices, but full autonomy for farmers is yet to materialize. To ensure intermediary influence continues to decline, investments in digital literacy, FPO-led aggregation, and language-friendly user interfaces are essential.

Table 5 Farmer Satisfaction Indicators Post-eNAM

Parameter % of Farmers Responding "Yes"

Parameter	% of Farmers Responding "Yes"
Satisfied with price received	81%
Believe eNAM is transparent	76%
Prefer eNAM over traditional mandi system	69%
Will continue using eNAM	84%
Recommend eNAM to other farmers	73%

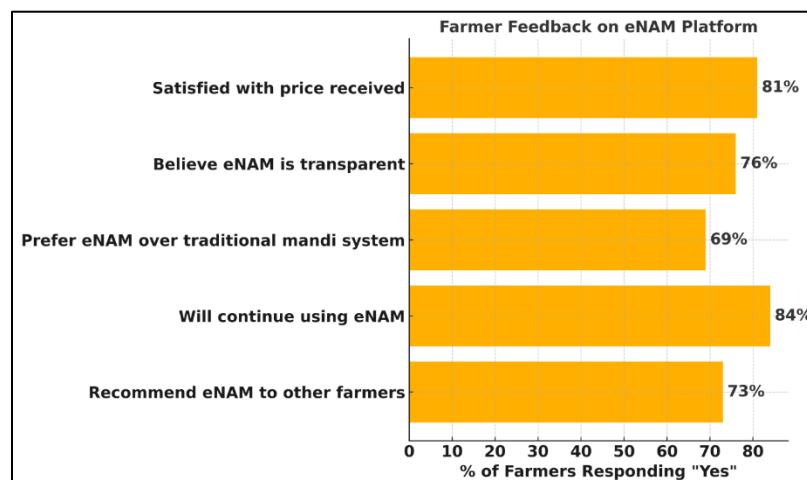


Figure 3 Analysis Farmer Feedback on ENAM Platform

3) Improvements in Income, Transparency, and Decision-Making

The introduction of eNAM has led to measurable improvements in income levels, especially among smallholders who previously had limited access to competitive markets. The average net income per acre rose by 15–18%, as reported by 59% of respondents. This was attributed to better prices and reduced commission costs. Additionally, real-time access to market prices enabled farmers to make informed decisions about when and where to sell their produce, leading to better timing and improved seasonal planning.

Transparency has also improved significantly. Unlike the opaque negotiation system in traditional mandis, eNAM ensures visibility of ongoing bids, which builds trust among farmers. Many also reported increased autonomy in pricing decisions, as they were no longer solely reliant on agent-provided rates. This empowerment has led to a shift in farmer mindset—from passive price takers to informed participants in the agri-market ecosystem.

4) Challenges Encountered by Farmers Using eNAM

- **Limited Internet Connectivity:** Many rural areas, especially parts of Nagpur, faced network issues affecting real-time bidding.
- **Low Digital Literacy:** Over 50% of farmers struggled with app navigation or digital registration.
- **Grading and Assaying Gaps:** Absence of standardized produce grading reduced trust in online quality-based pricing.
- **Partial Mandi Integration:** Not all APMC mandis offer full eNAM features, limiting utility.
- **Language Barriers:** While Marathi interface is available, technical terms are still hard to understand.
- **Reluctance to Trust Online Payments:** Some farmers still prefer cash transactions due to distrust in digital payments.
- **Dependence on Agents for Tech Support:** Intermediaries remain necessary for many users to access the platform.
- **Lack of Awareness of Additional Features:** Many users were unaware of logistics and storage support available on eNAM.

5. POLICY IMPLICATIONS

APMC Reforms Are Harmonised Across Districts

The consistent application of APMC changes in many districts and states is crucial to eNAM's success. The efficacy of the eNAM framework is limited in Maharashtra since certain districts, like Pune, have embraced the reforms more thoroughly than others, while others still only partially integrate digitally. Smooth inter-state and inter-district trade is

hampered by inconsistent mandi rules and differing levels of digital infrastructure. A level playing field for all parties involved depends on harmonising APMC Acts to permit complete licencing of traders, a single-point levy of market fees, and unified quality requirements. Farmers in the state and beyond would have more market prospects as a result of increased system trust and easier commodities transportation.

Investing in Mandi Infrastructure, Grading, and Assaying

Lack of appropriate grading and assaying systems, which are necessary for quality-based commerce on eNAM, was one of the biggest obstacles mentioned by farmers in this study. Due to concerns about inconsistent produce quality, buyers are reluctant to engage in online bidding in the absence of standardised infrastructure. Therefore, specific investments are required to set up automated auction facilities, electronic weighing systems, and modern labs throughout all APMC mandis that are integrated with eNAM. In addition to making price discovery more transparent and equitable, this also makes it possible for farmers to get paid more for superior produce. Upgrades to the mandi infrastructure, such as improved storage, digital kiosks, and hubs for internet connectivity, will also increase platform dependability and farmer involvement.

Programs for Digital Literacy and Capacity Building

According to the report, more over half of the farmers polled have only rudimentary or no digital literacy, which restricts their capacity to interact with eNAM on their own. A major worry in a tech-driven system is the digital divide. Large-scale capacity-building programs, such as community workshops facilitated by qualified facilitators, mobile app tutorials in local languages, and on-site training, are therefore desperately needed. In addition to teaching farmers how to use the eNAM app, these programs ought to educate them on price trends, market dynamics, and digital financial instruments. To ensure equitable involvement, special attention should be paid to marginalised groups like women, older farmers, and smallholders. Improving digital proficiency will enable farmers to take direct charge of their sales and drastically cut down on dependency on middlemen.

6. CONCLUSION

Important empirical insights into the changing dynamics of agricultural marketing under Maharashtra's Electronic National Agriculture Market (eNAM) are offered by this pilot study. According to the study, which looks at the answers of 150 farmers in the mandis of Pune, Nashik, and Nagpur, eNAM has significantly improved market access, price realisation, and transactional efficiency. Farmers reported a significant increase in buyers, improved quintal prices, and expanded market access, including chances for interstate trading. With more farmers now taking part directly in online auctions, the platform has also decreased dependency on middlemen, boosting farmers' profit margins and giving them more influence over marketing choices. Nevertheless, not everyone gains equally from eNAM. Its full potential is still being hampered by issues including poor internet connectivity, low levels of digital literacy, and insufficient facilities for grading and assaying, and partial mandi integration. Although their function has changed, intermediaries are still necessary for many farmers to use the platform, particularly those who are old or live in locations with limited access to digital technology. Indicators of farmer wellbeing, including higher income, confidence in market operations, and enhanced decision-making autonomy, were also shown to be strongly correlated with eNAM engagement. Policy efforts must concentrate on coordinating APMC changes across districts, funding mandi infrastructure, bolstering Farmer Producer Organisations (FPOs), and putting in place strong capacity-building and digital literacy initiatives in order to guarantee the sustainability and inclusivity of eNAM. Incentives for farmers and buyers to interact with the platform are also necessary to increase usage. To sum up, eNAM has the potential to revolutionise Indian agriculture, but achieving its full potential would necessitate institutional coordination, technical empowerment, and inclusive policymaking that is sensitive to local conditions. This study provides useful information for India's digital agricultural policy and lays the foundation for larger state-wide assessments.

CONFLICT OF INTERESTS

None.

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None.

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