



**An ethnographic investigation of the farmer profile and raise awareness about the opportunities and challenges associated with electronic national agriculture market – with a special reference to four district e-NAM mandis of Odisha**

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**ABSTRACT**

**CONTEXT:** Investigating the farmer profile and raising awareness about the opportunities and challenges associated with e-NAM mandis can help to promote the adoption of the platform and ensure that it is meeting the needs of farmers. By providing farmers with access to market information, logistics support, and quality testing facilities, e-NAM can contribute to the profitability and financial stability of farmers, improve the efficiency of the agricultural market, and contribute to sustainable food systems.

**OBJECTIVE:** The goal of this study to look into farmer awareness and to analyze the opportunities and challenges that farmers face when using the e-NAM platform.

**METHODS:** Observations and personal interviews are used to collect data, which is then utilized in arriving at conclusions concerning the manner in which Ethnographically observation of farmers life and their agricultural activities. Structured questionnaire with five-point Likert scale on 1) farmers awareness, 2) farmers opportunities and 3) farmers challenges related to e-NAM mandis. For this analysis, SPSS Statistics 24.0 and Smart-PLS4 were used.

**FINDINGS:** The study points out increasing farmers' awareness about e-NAM, farmers can make informed decisions about crop selection, production volumes, and quality, which can contribute to their profitability and financial stability.

**SIGNIFICANCE:** Indications of farmers' commitment to a future that is more environmentally friendly encompassed a convergence of ideas on the need for Incorporated e-NAM Leadership and cooperative partnership, and the need for savings to mitigate the risks of specialization in agriculture.

**KEY WORDS:** *Ethnographic investigation, Farmers awareness, e-NAM mandi, Structural Equation Modelling, Agriculture*

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## **1. INTRODUCTION**

E-NAM (Electronic National Agriculture Market) (**Rathore, R.,2018**) is an online platform that was launched by the Government of India in 2016 (**Bisen, J.,2018**). It is a pan-India electronic trading portal that facilitates the buying and selling of agricultural commodities through a digital platform (**Chand, R. 2016, Yadav, J.,2021**). The platform enables farmers to sell their produce to buyers from across the country without the need for physical presence at the mandi (marketplace) (**Kumar, R.,2020, Bisen, J.,2018**). The platform provides a transparent, efficient, and secure online market for agricultural produce and aims to improve the price realization and profitability of farmers. e-NAM connects all the Agricultural Produce Market Committees (APMCs) through an online network (**SINGH, N. K.,2021. Meena, G. L.,2019**). The platform aims to create a unified national market for agricultural commodities by integrating the existing APMC markets through a digital platform (**Subash, S. P.,2018**). This allows farmers to sell their produce (**Subash, S. P.,2018**) to buyers from anywhere in the country without the need for physical presence at the mandi. The online network also enables real-time price discovery and helps to eliminate intermediaries in the supply chain, which can reduce transaction costs for farmers and improve their price realization (**Nirmal, R. 2017**). The platform provides a transparent, efficient, and secure online market for agricultural produce and aims to promote the adoption of modern technology in agricultural marketing (**Sahoo, A. K., & Krishna, D. K. 2020**). e-NAM provides a single license for trading across all mandi markets within a state (**Sahoo, A. K., & Krishna, D. K. 2020**). The platform aims to create a unified national market for agricultural commodities by integrating the existing APMC markets through a digital platform (**Kumar, R.,2020**). One of the key features of the platform is the provision of a single trading license that is valid across all the mandis in a particular state. This eliminates the need for farmers and traders to obtain separate licenses for each mandi they wish to trade in, which can reduce transaction costs and simplify the trading process (**SINGH, N. K.,2020**). The single license provision helps to promote inter-mandi trade and creates a more level playing field for all market participants. Overall, the e-NAM platform aims to provide a transparent, efficient, and secure online market for agricultural produce, and the provision of a single license for trading across all mandis in a state is an important step towards achieving this goal (**Raman, B.2022, Kumar, R.,2020, Bisen, J.,2018**). e-NAM provides quality certification for agricultural produce traded through the platform. The platform has a Quality Testing and Certification (QTC) mechanism, which is a network of accredited laboratories that conduct quality testing and certification of agricultural commodities (**Sahu, A.,2020**). The QTC mechanism is available for all farmers and traders who use the e-NAM platform and provides them with access to quality testing services that can help to ensure that their produce meets the required quality standards (**Kalamkar, S. S.2019, Nirmal, R. 2017**). By providing quality certification services, e-NAM aims to increase the transparency and efficiency of agricultural markets and promote the adoption of modern technology in agricultural marketing. (**Cipriano, I. M.,2022**)

### **1.1. Farmers Awareness and e-NAM features**

e-NAM provides real-time price discovery for better and stable price realization for producers. The platform has a transparent and efficient price discovery mechanism that helps to determine the market price of agricultural commodities in real-time (**Raman, B.2022, Kumar, R.,2020, Bisen, J.,2018**). The platform enables farmers to view the prices of agricultural commodities in various mandis across

the country and choose the best price for their produce. The real-time price discovery mechanism of e-NAM helps to eliminate the information asymmetry that often exists in traditional agricultural markets (Mishra, G.,2019), where farmers may not have access to real-time market information and may be unaware of the prevailing market prices. e-NAM provides a more efficient supply chain (Pavithra, S.,2018) and warehouse-based sales (Venkatesh, P.,2021) for agricultural commodities. The platform enables farmers to sell their produce directly to buyers through a transparent and efficient online market (SINGH, N.K.,2021), which can help to reduce transaction costs and eliminate intermediaries in the supply chain. The platform also supports warehouse-based sales, where farmers can sell their produce directly from warehouses or cold storages, which can help to improve the efficiency of the supply chain (Banerjee, T.,2019). e-NAM's more efficient supply chain and warehouse-based sales model are designed to provide a transparent, efficient, and secure online market for agricultural produce, which can help to improve the income and livelihoods of farmers and promote the adoption of modern technology in agricultural marketing. (Banerjee, T.,2019, Pavithra, S.,2018)

e-NAM provides online payment directly to the bank accounts of the farmers (Prasad, A. P., & Rao, V. C. 2019). The platform has a payment system that enables buyers to make online payments for the agricultural produce they purchase through the platform (SINGH, N. K.,2021). Once the payment is made, the platform automatically transfers the payment amount to the bank account of the farmer who has sold the produce. e-NAM provides training on new technologies to farmers and other stakeholders in the agricultural sector (Prasad, A. P., & Rao, V. C. 2019). The platform conducts training and awareness programs to help farmers understand the benefits and opportunities of using e-NAM for selling their produce. The training programs conducted by e-NAM cover a wide range of topics related to agricultural marketing, including the use of modern technologies for improving the efficiency and transparency of agricultural markets (Pundir, R. S.,2021). The platform also provides training on the use of digital tools for accessing market information, selling agricultural produce online, and managing transactions through the e-NAM platform. (Samantaray, S. K.,2023)

e-NAM does not directly help farmers start contract farming, but it provides a platform for farmers to sell their produce under a contract farming arrangement (Samantaray, S. K.,2023). The e-NAM platform provides a transparent and efficient online market where farmers can connect with buyers who are interested in purchasing agricultural produce under a contract farming arrangement (Kumar, U., & Yadav, V. K. 2017). Contract farming (Jarial, S. (2022) is a production and marketing arrangement where farmers produce agricultural commodities based on a contract with buyers or processors (Sahu, A.,2021). Under this arrangement, farmers agree to produce a certain quantity and quality of produce, (Kumar, A., & Basu, S. (2022) and the buyer agrees to purchase the produce at a predetermined price (Malhotra, C., & Anand, R. 2020). Contract farming can provide several benefits to farmers, including access to better inputs, technology, and market information, as well as a guaranteed market for their produce (Deshmukh, S., & Patil, S. (2021). Through e-NAM, farmers can enter into contract farming agreements with buyers (Thakur, P.,2021), who are interested in purchasing agricultural produce directly from them. The platform provides a secure and transparent mechanism for entering into such agreements, which can help to reduce the risks and uncertainties associated with traditional contract farming arrangements. (Kumar, R.,2020)

**2. OBJECTIVES:** The goal of this study to look into farmer awareness and to analyze the opportunities and challenges that farmers face when using the e-NAM platform.

### **2.1. Research Problems:**

A number of problems plague farmers all over the world. These issues have a simultaneous direct and indirect impact on the farmer's eternity. Farming techniques and other components of agriculture can also consume time as well as finances. Farmers' problems are frequently overlooked in our nation at large. This article aims to raise their awareness of the e-NAM platform's opportunities and challenges.

## 2.2. Research questions:

- a. How interested are farmers in participating in the e-NAM platform?
- b. How many farmers are aware of the e-NAM platform?
- c. What are the challenges and opportunities for farmers to participate in the e-NAM platform?
- d. How should farmers respond to the e-NAM platform's challenges and opportunities?

## 3. METHODOLOGY:

Observations and personal interviews are used to collect data, which is then utilized in arriving at conclusions concerning the manner in which Ethnographically observation of farmers life and their agricultural function (da Silva Júnior, 2023). Structured questionnaire with five-point Likert scale on 1) farmers awareness, 2) farmers opportunities and 3) farmers challenges related to e-NAM mandis. For this analysis, percentage, mean, standard deviation, SPSS Statistics 24.0 and Smart-PLS4 were used.

### 3.1. Study Area

Jajapur e-NAM mandi from Jajapur district, Nischantkoil e-NAM mandi from Cuttack district, Balasore e-NAM mandi from Baleshwar district and Sakhigopal e-NAM mandi from Puri district were selected for ethnographic investigation of the farmer profile and raise awareness about the opportunities and challenges associated with electronic national agriculture market.

### 3.2. Sample size and data collection:

The probability method's multi-stage stratified random sampling technique (Taherdoost, H. 2016) were used to select the respondents. A total of 600 respondents were drawn from registered farmers in four e-NAM mandis, 150 from each. The field research was conducted between December 2022 and January 2023, with visits to e-NAM registered farmer families. The application of questionnaires in the form of an oral conversation with families was used to collect data.

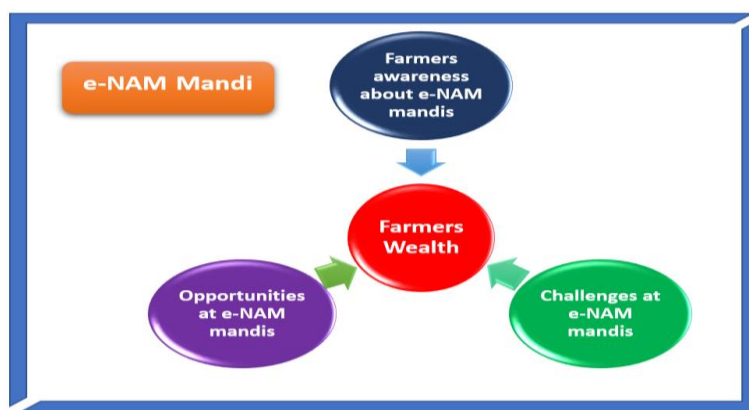


Figure:1 opportunities and challenges associated with e-NAM mandis

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### 3.3. Hypothesis

- H1 – Farmers have positive awareness of e-NAM mandi functions and procedures.
- H2 – Opportunities and Challenges of e-NAM mandis provides positive and significant impact on farmers awareness.

### 3.4. Structural Equation Modelling (SEM)

PLS-SEM is a very effective technique for developing and analysing complex models, as well as validating the complex model, and social science researchers should develop new techniques to manage more complex model relationships in their current and future studies. SEM based on the PLS technique was used to test the conceptual paths.

#### 3.4.1. Evaluation of Outer Measurement Model

The outer measurement model is aimed to calculate the reliability, internal consistency, and validity of the observed variables (measured through the questionnaire) together with unobserved variables [Ho. R.,2013]. Consistency evaluations are based on single observed and construct reliability tests whereas convergent and discriminant validity are used for the assessment of validity [Hair JF, 2012]. The key standards for evaluating the outer structural model:

- a. Construct reliability and validity
- b. Discriminant validity and convergent validity

#### 3.4.2. Evaluation of the Inner Structural Model

We confirmed that the measurement model was valid and reliable. The next step was to measure the Inner Structural Model outcomes. This included observing the model's predictive relevancy and the relationships between the constructs. The key standards for evaluating the inner structural model:

- a. The coefficient of determination ( $R^2$ ),
- b. Path coefficient ( $\beta$  value) and T-statistic value,
- c. Effect size ( $f^2$ ),
- d. The Predictive relevance of the model ( $Q^2$ ), and
- e. Goodness-of-Fit (GOF) index

## 4. RESULTS AND CONCLUSION:

### 4.1. Demographic profile of farmers:

Table 1 shows the demographic profile of farmers, which includes gender, marital status, age, monthly income, family size, farming experience, educational level, land holding, and FPO membership.

Table – 1 Demographic information of farmers

Variables	Factors	Farmers (N = 270)	
		Frequency	%
Gender	Male	460	76.67
	Female	140	23.33
Marital status	Single	114	19.00
	Married	486	80.74
Age	18-35	153	25.50
	36-45	227	37.83
	46-55	159	26.50

Monthly income	56-65	42	7.00
	65 and above	19	3.17
	Less than 20,000	129	21.49
	20,000 – 50,000	180	30.00
	50,000 – 70,000	158	26.30
	70,000 – 1,00,000	100	16.67
	Above 1,00,000	33	5.56
Family size	Less than 5	78	13.00
	6 – 10	174	29.00
	10 – 15	204	34.00
	16 and above	144	24.00
Farming experience	Less than 5 years	128	21.33
	6 – 10 years	169	28.17
	10 – 15 years	186	31.00
	15 – 20 years	117	19.50
	20 and above	117	19.50
Educational level	Primary education	84	14.00
	Secondary education	189	31.50
	Graduate education	245	40.83
	PG education	82	13.67
Land holding	Own land	309	51.48
	Rented land	167	27.78
	Borrowed land	73	12.22
	Contracted land	51	8.52
Member of FPO	Yes	192	32.00
	No	408	68.00

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**Table – 2 Awareness of farmers related to e-NAM mandi**

S. no.	Questionnaire on Awareness farmers related to e-NAM mandi	Mean	S.D.
1.	Do you know e-NAM is an online platform?	3.854	0.023
2.	Do you know e-NAM is connects all APMC mandis through online network?	3.546	1.763
3.	Do you know e-NAM is provides single license for trading across all mandi markets in a state?	3.795	1.014
4.	Do you know e-NAM provides quality certification?	3.475	0.746
5.	Do you know e-NAM provides Real time price discovery for better & stable price realization for producers?	3.617	1.881
6.	Do you know e-NAM provides More efficient supply chain & warehouse-based sales?	3.371	1.622
7.	Do you know e-NAM provides online payment directly to the bank accounts of the farmers?	3.818	0.150
8.	Do you know e-NAM provides training on new technologies?	3.260	1.512
9.	Do you know e-NAM helps you to start contract farming?	3.530	1.751

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**Hypothesis: H1** – The initial prerequisite for farmers to fully comprehend the participants' perceptions is to be aware of the electronic process of the e-NAM platform. To gauge awareness, respondents were given questions about the e-NAM online process, its online features, and its benefits. The level of awareness is determined by the responses of the participants. Participants were classified using a 5-point Likert scale.

Figure 1.1 demonstrates that 37.33 percentage and 30% of those polled are completely aware, respectively, and 20% are moderately aware that the e-NAM is an electronic platform. 7.67% and 5.83% of respondents were unaware that the e-NAM is an electronic platform.

According to Figure 1.2, 30.83 percent and 23.83 percent of respondents are aware of the e-NAM, which is a pan-India electronic trading portal that connects the existing APMC mandis to create a single national marketplace for commodities related to agriculture. 21.67 percent of respondents are moderately aware of e-NAM, which is an electronic platform that creates an electronic trading the marketplace linking the APMC mandis. 15.83 percent and 7.83 percent of respondents are less aware of e-NAM mandis, respectively.

The data in Figure 1.3 indicates that 41.83 percent of farmers are fully aware that e-NAM provides a single license for all types of crops trading, 24 percent and 13 percent of respondent farmers are well aware and moderately aware of the license procedure of the e-NAM platform, respectively, and 14 percent and 7 percent of respondent farmers are less aware and unaware of the license procedure of the e-NAM platform, which allows them to trade all agricultural commodities.

Figure 1.4 demonstrates that 35.83 percent and 14.83 percent respectively of farmers are fully aware of the quality certification mark given to agricultural products that meet the e-NAM mandi's superiority and purity norms. 20.83 percent of farmers are moderately aware, while 18 percent and 10.5 percent of respondents are less knowledgeable and unaware about the quality certification mark awarded to agricultural products that meet the quality as well as purity standards set by the e-NAM mandi.

Figure 1.5 shows that 40% of respondents were well aware, 17.5 percent and 18.33 percent of respondents are aware and very less aware of the e-NAM mandi, which is a pan-India electronic trading portal that promotes real-time price discovery of agricultural products based on actual supply and demand.

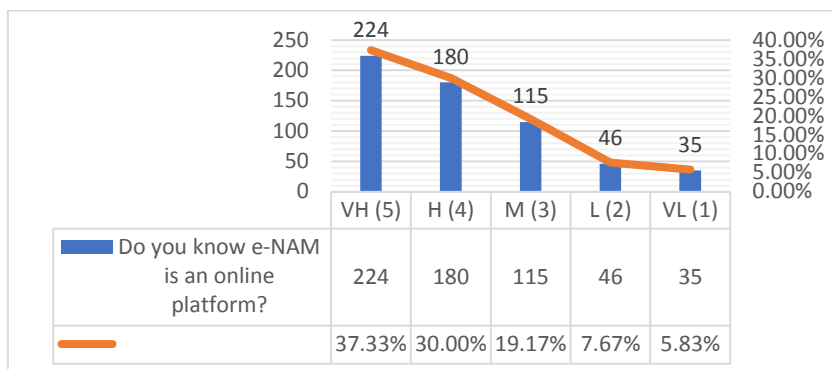


Fig-1.1

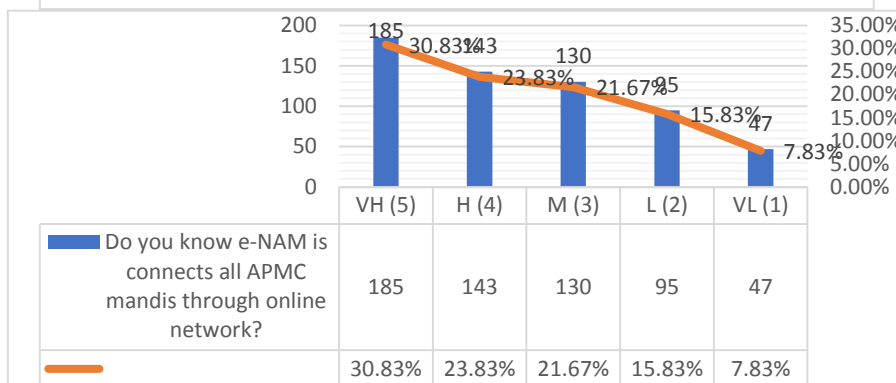


Fig-1.2

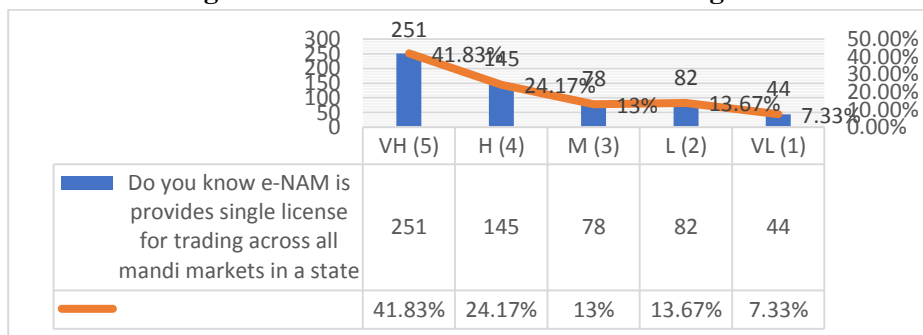


Fig-1.3

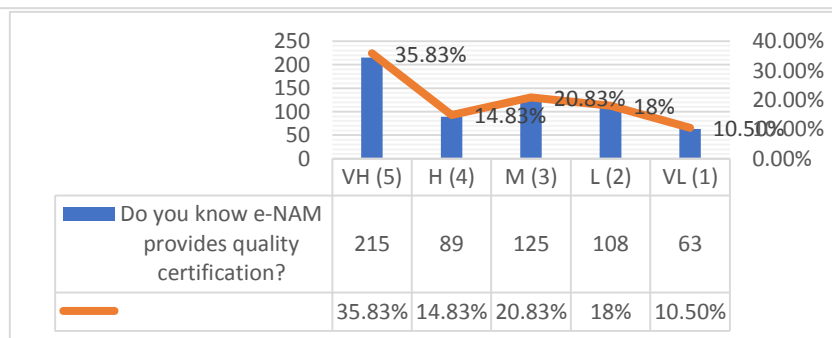


Fig-1.4



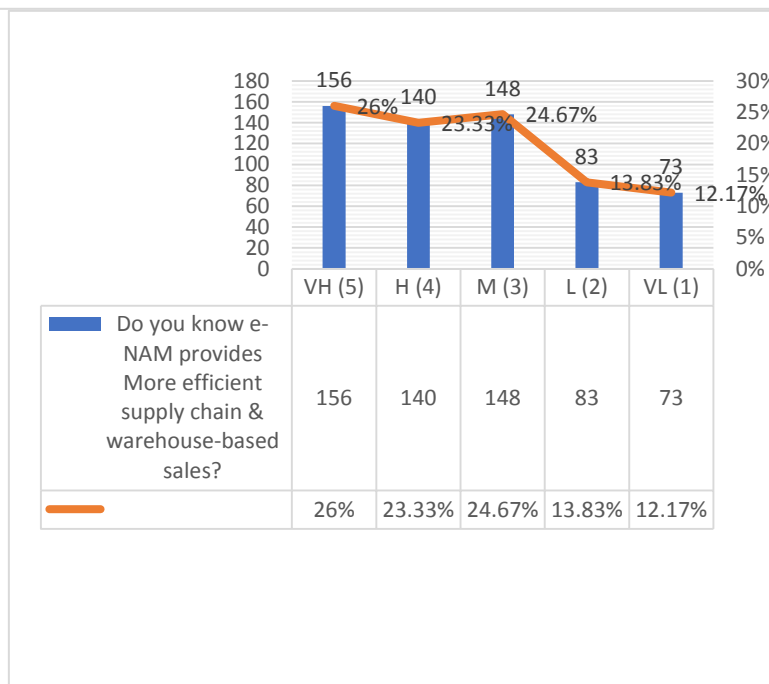
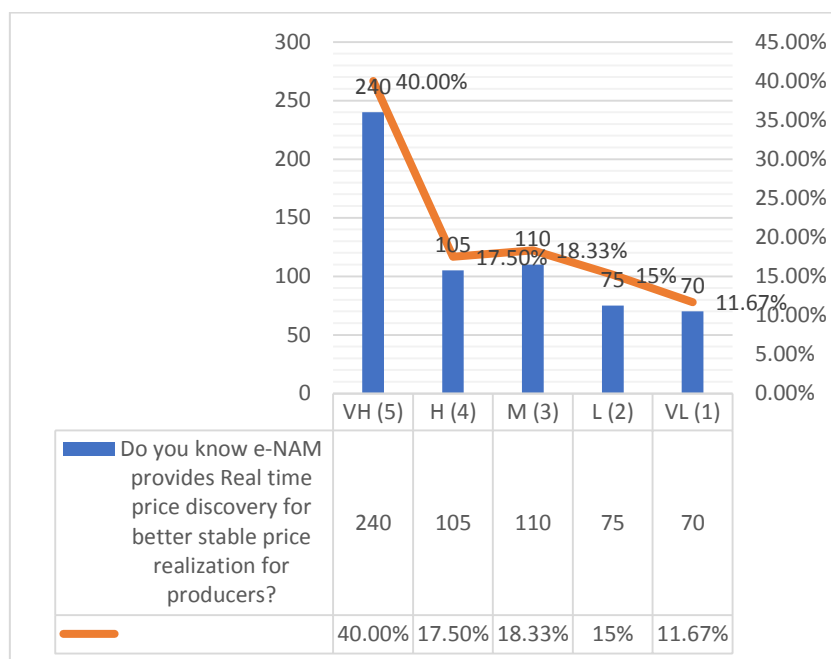


Fig-1.5

Fig-1.6

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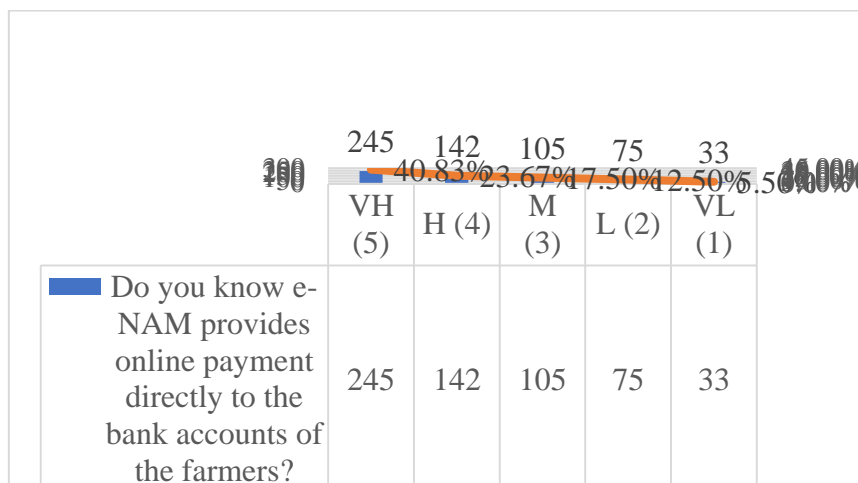


Fig-1.7

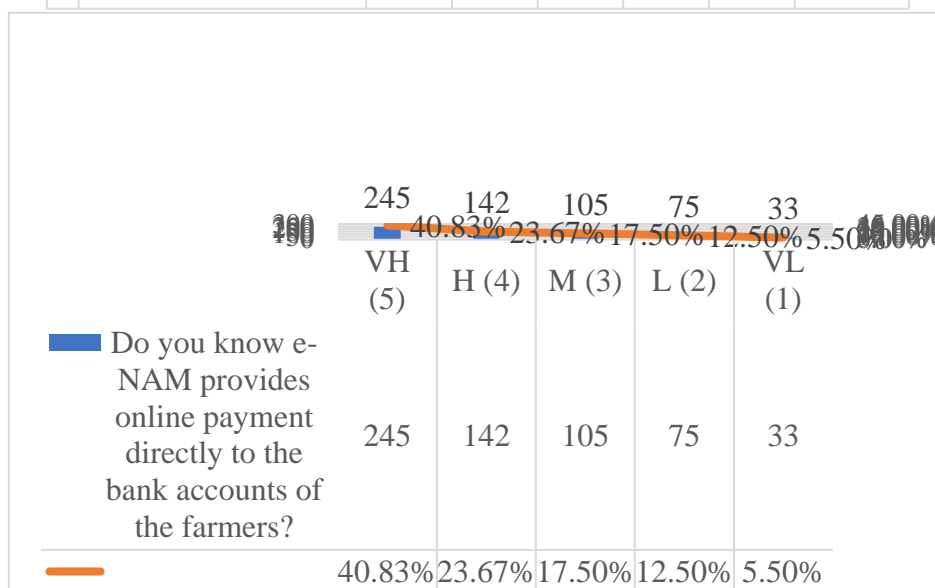


Fig-1.8

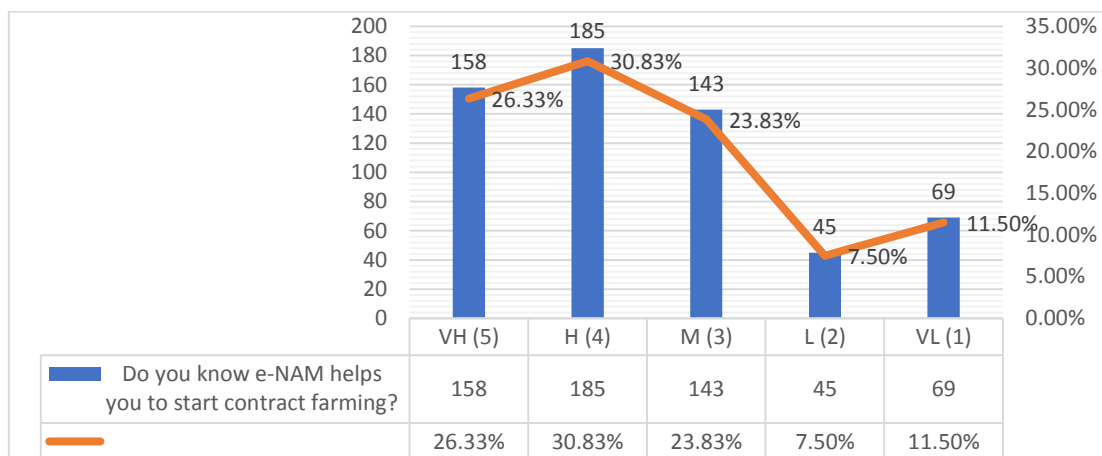


Fig – 1.9

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Figure 1.6 demonstrates that 26 percent of respondents were fully aware, 23.33 percent and 24.67 percent of respondents are aware and very less aware of e-NAMs' efficient supply chain management (SCM) and warehouse sales, which aid in agricultural commodity price stabilization, which is critical for maintaining financial efficiency and efficacy.

According to Figure 1.7, 20.83 percent of respondents are well-aware, 24.67 percent and 28.67 percent are aware and moderately aware, respectively, and 11.67 percent and 13.83 percent are unaware of an agricultural sector development training workshop on Agricultural Technology Transfer and Adoption of Technologies for Sustainable Farming Systems at e-NAM Mandi.

Figure 1.8 shows that 40.83 percent of respondent farmers are well aware, 23.67 percent and 17.5 percent are aware and moderately aware, and 12.5 percent and 5.5 percent are unaware of e-NAM mandi online payment systems. Payment sources include Bank Challan, Net Banking, BHIM App, and Pay2Corp.

Contract farming is an agreement between farmers and marketing firms for the production and supply of agricultural products under forward contracts, often at predetermined prices. Figure 1.9 shows that 26.33 percent of farmers are well-aware of how e-NAM mandi helps farmers start contract farming with big firms, 30.83 percent and 23.83 percent of farmers are aware and moderately aware of how e-NAM mandi helps farmers start contract farming with big firms, and 7.5 percent and 11.5 percent of farmers are less aware and unaware.

**Hypothesis (H2)** – Opportunities and Challenges of e-NAM mandis provides positive and significant impact on farmers awareness.

The responses obtained from the 600 farmers analysed by principal Component Analysis, Correlation and Regression Analysis. The model of e-NAM awareness, opportunities and challenges of farmers developed using SEM technique and the results are presented here under suitable headings.

**Table – 3 Opportunities and challenges to the farmers in e-NAM platform: response of farmers on most appropriate.**

Sl. No.	Opportunities	SA (5)	A (4)	N (3)	D (2)	SD (1)	Mean	S.D.
<b>Infrastructure Opportunities (ISO)</b>								
1.	Quality testing and grading of crops facility are available in e-NAM mandis (ISO <sub>1</sub> )	133 22.17%	230 38.33%	75 12.5%	96 16%	66 11%	3.447	1.292
2.	Available of Warehouse facility for both perishable or non-perishable produce in e-NAM mandis (ISO <sub>2</sub> )	175 29.17%	213 35.5%	60 10%	95 15.83%	57 9.5%	3.590	1.372
3.	Available of required numbers of computers and kiosks in e-NAM	201 33.5%	175 29.17%	88 14.67%	82 13.67%	54 9%	3.645	1.308

	mandis (ISO <sub>3</sub> )							
4.	Available of internet connection (Wi-Fi) for every stakeholder in Mandi premises (ISO <sub>4</sub> )	215 35.83%	89 14.83%	125 20.83%	108 18%	63 10.5%	3.475	1.398
5.	Mandis' workers are efficient and easily handle workload in peak seasons (ISO <sub>5</sub> )	226 37.67%	125 20.83%	84 14%	105 17.5%	60 10%	3.587	1.394
<b>Technological Opportunities (TLO)</b>								
6.	Training on technological literacy to farmers provided at e-NAM mandi premises (TLO <sub>1</sub> )	224 37.33%	185 30.83%	95 15.83%	66 11%	30 5%	3.845	1.181
7.	Quality Assaying machines and tools are good in measuring the quality of commodity brought to the e-NAM mandi (TLO <sub>2</sub> )	185 30.83%	143 23.83%	130 21.67%	95 15.83%	47 7.83%	3.111	1.354
8.	There are no Server issues in mandis premises (TLO <sub>3</sub> )	224 37.33%	170 28.33%	115 19.17%	56 9.33%	35 5.83%	3.820	1.195
9.	e-NAM application and e-auctioning are easily managed by farmers (TLO <sub>4</sub> )	170 28.33%	143 23.83%	130 21.67%	110 18.33%	47 7.83%	3.633	1.313
10.	Providing trainings camps at e-NAM mandi premises on use of water, fertilizer, and pesticides in agricultural production (TLO <sub>5</sub> )	246 41%	145 24.17%	78 13%	87 14.5%	44 7.33%	2.810	1.627
<b>Trading Opportunities (TRO)</b>								
11.	Always available of traders at the time of e-auctioning in e-NAM mandi (TRO <sub>1</sub> )	245 40.83%	105 17.5%	82 13.67%	95 15.83%	73 12.17%	3.590	1.450
12.	e-NAM provides Manipulation free online auctioning of agricultural produces (TRO <sub>2</sub> )	156 26%	140 23.33%	148 24.67%	83 13.83%	73 12.17%	3.371	1.342
13.	e-NAM always focus immediate payments after sale of agricultural produces (TRO <sub>3</sub> )	245 40.83%	142 23.67%	105 17.5%	75 12.5%	33 5.5%	3.818	1.420
14.	Monthly training camps are organized to understand the trading facilities of e-NAM platform (TRO <sub>4</sub> )	125 20.83%	148 24.67%	172 28.67%	70 11.67%	83 13.83%	3.260	1.294
15.	e-NAM provides Risk free online payment (TRO <sub>5</sub> )	158 26.33%	185 30.83%	143 23.83%	45 7.5%	69 11.5%	3.530	1.270
<b>Infrastructure Challenges (ISC)</b>								

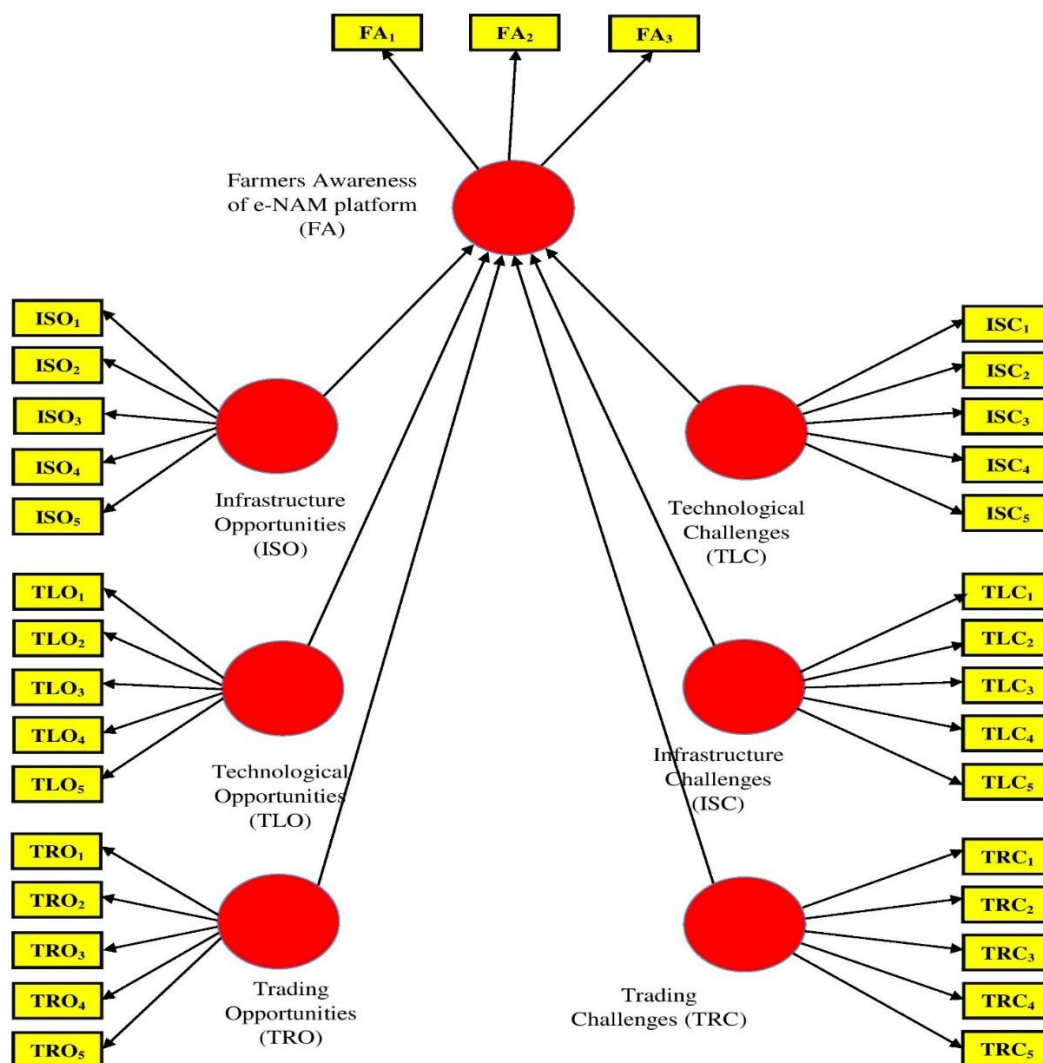
16.	No quality testing and grading of crops facility available in e-NAM mandis (ISC <sub>1</sub> )	85 14.17%	74 12.33%	45 7.5%	178 29.67%	221 36.83%	<b>2.375</b>	<b>1.437</b>
17.	Lack of warehouse facility for perishable or non-perishable produce in e-NAM mandis (ISC <sub>2</sub> )	75 12.5%	102 17%	65 10.83%	154 25.17%	204 34%	<b>2.483</b>	<b>1.421</b>
18.	Inadequate numbers of computers and kiosks in e-NAM mandis (ISC <sub>3</sub> )	89 14.83%	87 14.5%	45 7.5%	142 23.67%	237 39.5%	<b>2.415</b>	<b>1.462</b>
19.	Poor internet connection (Wi-Fi) in Mandi premises (ISC <sub>4</sub> )	67 11.17%	115 19.67%	51 8.5%	136 22.67%	231 38.5%	<b>2.418</b>	<b>1.445</b>
20.	Mandis' workers are incapable of performing workload in peak seasons (ISC <sub>5</sub> )	68 11.33%	110 18.33%	45 7.5%	122 20.33%	255 42.5%	<b>2.354</b>	<b>1.348</b>
<b>Technological Challenges (TLC)</b>								
21.	Lack of technological literacy of farmers and mandis workers (TLC <sub>1</sub> )	58 9.67%	45 7.5%	74 12.33%	175 29.17%	248 41.33%	<b>2.235</b>	<b>1.025</b>
22.	Quality Assaying machines and tools are slow in measuring the quality of commodity brought to the mandi (TLC <sub>2</sub> )	65 10.83%	86 14.33%	66 11%	136 22.67%	247 41.17%	<b>2.458</b>	<b>1.224</b>
23.	Server issues are common in mandis premises (TLC <sub>3</sub> )	82 13.67%	55 9.17%	63 10.5%	157 26.17%	243 40.5%	<b>2.654</b>	<b>1.023</b>
24.	e-NAM application and e-auctioning less appropriate to farmers (TLC <sub>4</sub> )	75 12.5%	81 13.5%	89 14.83%	146 24.33%	209 34.83%	<b>2.480</b>	<b>1.048</b>
25.	Very a smaller number of training camps are providing in e-NAM mandi premises on use of water, fertilizer, and pesticides, which in turn keeps food prices down (TLC <sub>5</sub> )	58 9.67%	73 12.17%	93 15.5%	133 22.17%	243 40.5%	<b>2.636</b>	<b>1.047</b>
<b>Trading Challenges (TRC)</b>								
26.	Less of traders available at the time of e-auctioning in e-NAM mandi. (TRC <sub>1</sub> )	<b>79</b> <b>13.17%</b>	75 12.5%	<b>111</b> <b>18.5%</b>	<b>144</b> <b>24%</b>	<b>191</b>	<b>2.961</b>	<b>1.457</b>
27.	Manipulation of online auctioning is common in e-NAM mandis. (TRC <sub>2</sub> )	<b>84</b> <b>14%</b>	68 11.33%	<b>102</b> <b>17%</b>	<b>158</b> <b>26.33%</b>	<b>188</b> <b>31.33%</b>	<b>2.846</b>	<b>1.475</b>

<b>28.</b>	e-NAM doesn't focus on delay in receiving payments after sale of agricultural produces (TRC <sub>3</sub> )	<b>75</b> <b>12.5%</b>	66 11%	<b>162</b> <b>27%</b>	<b>122</b> <b>20.33%</b>	<b>175</b> <b>29.17%</b>	<b>2.647</b>	<b>1.024</b>
<b>29.</b>	Fewer training camps are organized to understand the trading functions of e-NAM platform (TRC <sub>4</sub> )	<b>48</b> <b>8%</b>	87 14.5%	<b>149</b> <b>24.84%</b>	<b>132</b> <b>22%</b>	<b>184</b> <b>30.67%</b>	<b>2.521</b>	<b>1.329</b>
<b>30.</b>	Risk of fraud in online payment (TRC <sub>5</sub> )	<b>56</b> <b>9.33%</b>	54 9%	<b>177</b> <b>29.5%</b>	<b>136</b> <b>22.67%</b>	<b>177</b> <b>29.5%</b>	<b>2.666</b>	<b>1.033</b>
<b>Farmers Awareness of e-NAM platform (FA)</b>								
<b>31.</b>	Infrastructure Facilities (FA <sub>1</sub> )	<b>245</b>	174	<b>12</b>	<b>89</b>	<b>80</b>	<b>3.416</b>	<b>1.230</b>
<b>32.</b>	Technological Facilities (FA <sub>2</sub> )	<b>184</b>	217	<b>36</b>	<b>108</b>	<b>55</b>	<b>3.021</b>	<b>1.547</b>
<b>33.</b>	Trading Facilities (FA <sub>3</sub> )	<b>264</b>	140	<b>16</b>	<b>100</b>	<b>80</b>	<b>3.524</b>	<b>1.454</b>

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#### 4.2. Structural Equation Modelling

The Smart Partial Least Square (Smart PLS) software is used for the Structural Equation Modelling (SEM) (Wong, K. K. K. (2019)). The structural model as shown in Figure 3 is proposed. The path coefficients are estimated and examined by the Constructs' test of the Structural Equation Model. Path coefficients are the pointers of the model's predictive ability. (Comrey, 1973, Hulland, 1999)



**Figure 3: Farmers Awareness Structural Equation Model.**  
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**a. Reliability Analysis**

The inner consistency of measurement model is analysed by using Cronbach’s alpha and composite reliability. Valuation of construct reliability and prediction of inner consistency is focused on composite reliability. The cut-off score for composite reliability is considered 0.7 as suggested by **Gefen et al. (2000)** and the least score is taken as 0.6 for Cronbach’s Alfa as suggested by **Hair et al. (2009)**. The Cronbach's alpha values obtained in the study are found to be more than 0.710, and composite reliability score obtained is more than 0.740 and hence, the model is found to be reliable and trustworthy.

**b. Convergence Analysis**

The convergent validity of dignified constructs is assessed using Average Variance Extracted (AVE) tests, composite reliability scores and Cronbach’s alpha, using Smart PLS software, and the consequences are presented in Table 4. These results show that the AVE scores of constructs are greater than 0.590, which represent good convergent validity. (**Fornell and Larcker 1981**)

**Table 4: Reliability and Convergence Validity Test Results**

Main construct	Items	Loading	Cronbach's Alpha	CR	AVE
Infrastructure Opportunities	ISO <sub>1</sub>	0.746	0.868	0.967	0.621
	ISO <sub>2</sub>	0.751			
	ISO <sub>3</sub>	0.856			
	ISO <sub>4</sub>	0.861			
	ISO <sub>5</sub>	0.752			
Technological Opportunities	TLO <sub>1</sub>	0.810	0.811	0.877	0.598
	TLO <sub>2</sub>	0.847			
	TLO <sub>3</sub>	0.769			
	TLO <sub>4</sub>	0.732			
	TLO <sub>5</sub>	0.764			
Trading Opportunities	TRO <sub>1</sub>	0.774	0.769	0.856	0.622
	TRO <sub>2</sub>	0.759			
	TRO <sub>3</sub>	0.804			
	TRO <sub>4</sub>	0.766			
	TRO <sub>5</sub>	0.715			
Infrastructure Challenges	ISC <sub>1</sub>	0.842	0.801	0.918	0.648
	ISC <sub>2</sub>	0.881			
	ISC <sub>3</sub>	0.819			
	ISC <sub>4</sub>	0.876			
	ISC <sub>5</sub>	0.767			
Technological Challenges	TLC <sub>1</sub>	0.616	0.873	0.869	0.683
	TLC <sub>2</sub>	0.882			
	TLC <sub>3</sub>	0.612			
	TLC <sub>4</sub>	0.821			
	TLC <sub>5</sub>	0.724			
Trading Challenges	TRC <sub>1</sub>	0.745	0.806	0.901	0.661
	TRC <sub>2</sub>	0.826			
	TRC <sub>3</sub>	0.893			
	TRC <sub>4</sub>	0.741			
	TRC <sub>5</sub>	0.716			
Awareness of farmers	FA <sub>1</sub>	0.847	0.898	0.748	0.697
	FA <sub>2</sub>	0.891			
	FA <sub>3</sub>	0.886			

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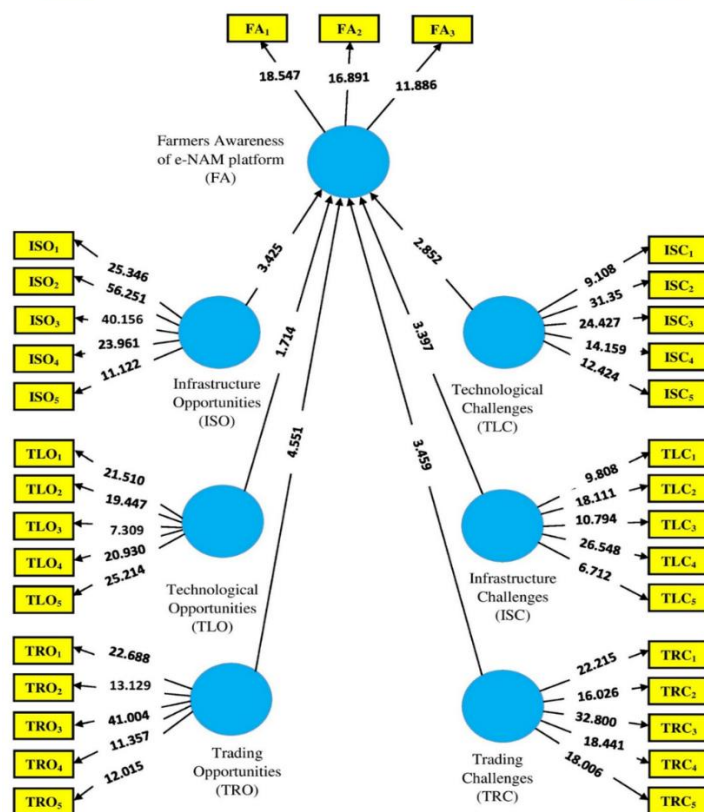
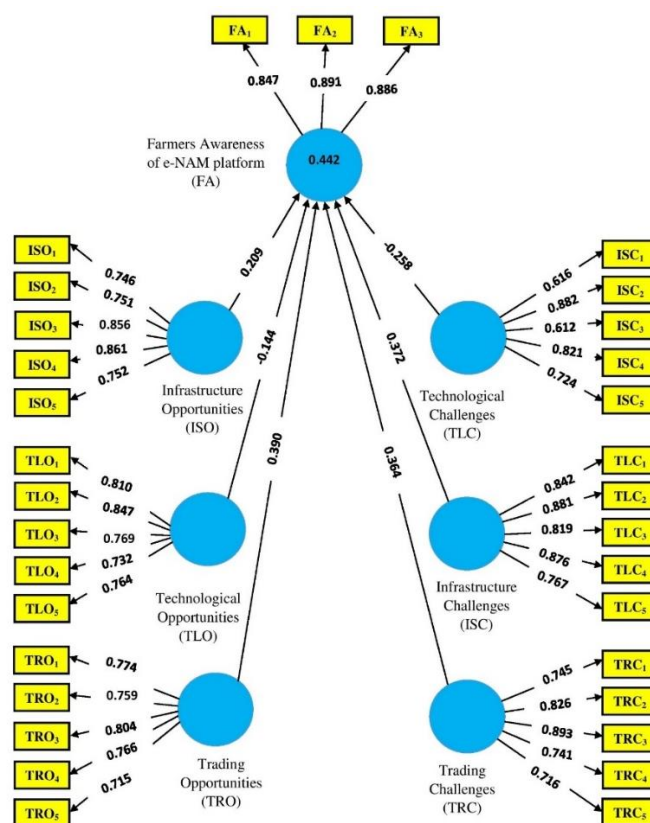


Figure 4: Final path model of SEM Analysis: Farmers Awareness Model

Figure 5: Bootstrapping Diagram: Farmers Awareness Model

## Farmers Awareness Model

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### c. Discriminant Validity Analysis

The degree to which any single construct differs from the other constructs in the model is referred to as discriminant validity (**Ab Hamid, M. R.2017**). The components of each construct in the model should be distinct from those of other constructs. The findings of the discriminant validity analysis are shown in table 5. This table shows that there is a good degree of diversity between each construct and other constructs.

**Table 5: Discriminant Validity Results**

Factor group	ISO	TLO	TRO	ISC	TLC	TRC	FA
ISO	0.783	-----	-----	-----	-----	-----	-----
TLO	0.223	0.805	-----	-----	-----	-----	-----
TRO	0.489	0.399	0.722	-----	-----	-----	-----
ISC	0.510	0.452	0.614	0.735	-----	-----	-----
TLC	0.351	0.446	0.370	0.741	0.718	-----	-----
TRC	0.389	0.108	0.444	0.354	0.533	0.621	-----
FA	0.429	0.158	0.547	0.254	0.441	0.401	0.845

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### d. Structural Equation Model: Path Coefficient

A path coefficient evaluation is performed to arrive at the structural equation model, which indicates the strength of the relationships between the R-square value, independent variables, and dependent variables. On a sample size of 600, a bootstrapping resampling technique (**Tibshirani, R.J. 1993**) is used to define the consequence level of the paths defined within the structural model. The resultant t-value indicates the level of significance using the extent of the identical factor estimates between the constructs. Figure 5 and Table 6 show the structural model's bootstrapping diagram and path coefficients.

**Table 6: Path Coefficients of the Structural Equation Model**

Factor group	Original sample (O)	Sample mean (M)	Standard Deviation (STDEV)	T-statistics	Supported or not supported	Significance value
ISO->FA	0.209	0.222	0.061	3.425	Yes	0.001
TLO-> FA	-0.144	-0.108	0.085	1.714	No	0.254
TRO-> FA	0.390	0.389	0.074	4.551	Yes	0.000
ISC->FA	-0.258	-0.264	0.091	2.852	Yes	0.005
TLC-> FA	0.372	0.351	0.054	3.397	Yes	0.000
TRC-> FA	0.364	0.273	0.102	3.459	Yes	0.001

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**e. Goodness of fit:**

Goodness-of-fit (GOF) is recommended as a worldwide fit measure for PLS path modelling. The goodness-of-fit (GOF) measure is used in conjunction with the evaluation of PLS path modelling in this study. (Hair Jr, J. F.,2017, Ainur, A. K.,2017)

According to Table 7, the GOF value calculated for this model is 0.335. GOF large = 0.36, GOF small = 0.1, and GOF medium = 0.25 are the baseline values for validating the PLS model globally (Akter et al. 2011).

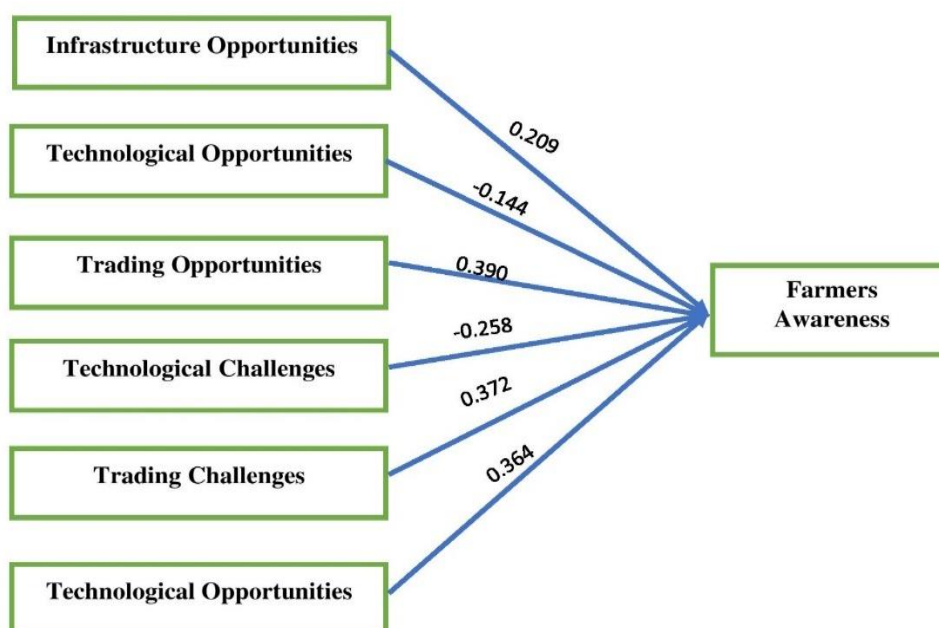
**Table 7: Goodness of Fit: Model Evaluation Results**

Factors	R <sup>2</sup>	Communality	H <sup>2</sup>	Redundancy	F <sup>2</sup>
Infrastructure Opportunities	-----	0.328	0.000	-----	0.024
Technological Opportunities	-----	0.102	0.000	-----	0.027
Trading Opportunities	-----	0.298	-----	-----	0.024
Infrastructure Challenges	-----	0.193	0.000	-----	0.058
Technological Challenges	-----	0.221	0.000	-----	0.030
Trading Challenges	-----	0.295	-----	-----	0.065
Farmers Awareness	0.442	0.346	-----	0.258	-----
Average	0.442	0.254	-----	0.258	-----

GOF =  $\sqrt{\text{average } R^2 \times \text{average communality}} = \sqrt{0.442 \times 0.258} = 0.335$   
 Note: H<sup>2</sup> = CV – Communality index, F<sup>2</sup> = CV – Redundancy Index

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The q-square statistic is calculated to evaluate the superiority of path model. As q-square is greater than zero i.e., 0.259 vide fig 7, the model has predictive significance. The following figures 6 and 7 show the predictive significance of the model in farmers awareness.



**Figure 6: Predictive Significance Diagram: farmers Awareness Model**

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#### **4.3. Implications of research:**

the e-NAM essentially expands a farmer's options when he brings his produce to the mandi for sale. Local traders, as well as traders from other states using the electronic platform, may place offers on the agricultural produce. The farmer can choose between accepting the local or electronically offer. In either case, the transaction will be documented on the local mandi's books, and the charge for the transaction will continue to be collected. In reality, as competition for specific produce increases, the volume of business will increase significantly, resulting in higher transaction fees for the e-mandi.

Interestingly, palatable stakeholders to join the e-NAM platform keeps being a persistent issue in numerous locations. Farmers, traders, and commission brokers all have problems. The trader is concerned about entering the tax structure once he conducts business via electronic means, the farmer is conscious about receiving cheaper prices if his crop undergoes testing (quality tested), and the commission agent is concerned about eventually being shut out of the system. One depends off the other's fears, and they work together to keep the current situation quo. Obviously, more needs to be accomplished.

Farmers' understanding of e-NAM (the Electronic National Agriculture Market) is critical in encouraging platform adoption and use. Several methods exist for increasing farmer awareness of e-NAM, including:

- ✚ Training and education programmes can be organised by government agencies, agricultural organisations, and private sector companies to educate farmers about the many advantages of e-NAM, how to use the platform, and how to make use of the services and information available through e-NAM. These programmes can be delivered in a variety of formats, including seminars, training sessions, and field experiments.
- ✚ Access to information: Farmers require trustworthy and accurate marketplace data, such as current market prices, demand for various products, and quality standards. Farmers have access to this knowledge via e-NAM, and efforts need to be made to guarantee that farmers have easy and timely access to this information. This can be accomplished by offering applications for smartphones, SMS services, and various other online platforms.
- ✚ Conducting outreach programmes: To reach out to farmers and promote the benefits of e-NAM, government agencies, agricultural organisations, and private sector companies can conduct outreach programmes. Visits to rural neighbourhoods, farmer gatherings, and exhibitions are examples of such programmes.
- ✚ Offering incentives: The government can offer financial incentives, subsidies, and exemptions from taxes to farmers who use e-NAM. This might motivate farmers to use the platform and take advantage of its services.
- ✚ Providing infrastructure, logistics support, and digital payment options to make e-NAM more accessible: Infrastructure, logistics support, and digital payment facilities can be provided by government organisations and private sector companies to facilitate easy access to e-NAM. This has the potential to lower transaction costs while also making it easier for farmers to market their crops on the platform.

- ✚ Farmers should practise sustainable farming practises such as crop rotation, intercropping, the use of organic fertilisers and pesticides, and conservation tillage. These practises can help to improve soil health, conserve water, and reduce the use of hazardous chemicals in agriculture.
- ✚ Farmers should use modern technologies such as precision agriculture, drip systems, and biotechnology to increase agricultural profitability and effectiveness. These technologies can assist in lowering input costs, increasing yields, and reducing greenhouse gas emissions.
- ✚ Form farmer cooperatives: Farmers should form co-operatives to increase their market negotiating influence and access to services that include credit, insurance, and marketing.
- ✚ Diversify farmers income sources: Farmers ought to increase their earnings sources by participating in ecotourism, agricultural forestry, and farming for livestock. This may contribute to reduce their reliance on agriculture while also increasing their resilience to unexpected events.

Overall, farmers' sustainable growth necessitates a mix of policy interventions, advancements in technology, and modifications in agricultural practises and behaviour. Farmers are able to make more educated choices about crop selection, quantity of production, and quality by boosting their awareness of e-NAM, which could be beneficial to their revenue and sustainability. Farmers can also increase consumer interest in their produce and potentially communicate better prices by using the platform to sell directly to buyers from other regions. Overall, e-NAM can provide farmers with a variety of resources and knowledge that can help improve agricultural commodity production and sales.

## **5. CONCLUSION**

Finally, sustainable farmer development is critical for ensuring food security, reducing unemployment, and protecting the environment. To achieve sustainable development, farmers should practise environmentally friendly agricultural practises, use modern technology and market knowledge, form cooperatives, participate in training and capacity-building programmes, preserve ecosystems, and diversify their income sources. Governments and other stakeholders can help by enacting policies and programmes that promote sustainable agriculture, increase access to markets and services, and protect the environment. Farmers, governments, and other stakeholders can work together to create a more sustainable and reasonable agricultural system that benefits everyone.

In conclusion, raising awareness of the e-NAM platform can aid in the sustained growth of farmers. Farmers can benefit from e-NAM by having access to reliable and precise market information, quality accreditation, real-time determination of prices, and online payment methods, which can help them increase their earnings and reduce the risks associated with the market. Furthermore, e-NAM can assist farmers in adopting sustainable farming practises, cutting-edge equipment, and business management skills, which can help increase agricultural profitability and effectiveness. To fully reap the benefits of e-NAM, farmers must first become acquainted with the platform and how it can meet their specific needs. As a result, efforts should be made to raise farmer awareness of the e-NAM platform while also providing them with the necessary training and support to use it effectively. This can be accomplished through targeted communication campaigns, training sessions, and other programmes that build capacity aimed at farmers and their communities.

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