Journal of Namibian Studies, 32 (2022): 609-632 ISSN: 2197-5523 (online)

Special Issue 0n Multidisciplinary Research

Exploring Challenges In The Adoption And Implementation Of The E-NAMPlatform In Indian Agricultural Marketing

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Abstract:

This paper scrutinizes the challenges hindering the widespread adoption and effective implementation of India's e-NAM platform in agricultural marketing. It addresses persistent issues in post-harvest marketing impacting farmers and the economy. Despite its transformative potential, the e-NAM platform's success hinges on farmer acceptance. The comprehensive literature review emphasizes the platform's intentions, desired outcomes, and the shift from traditional to digital agricultural trading. Methodologically, the study employs surveys and qualitative insights, analyzing data from Haryana. Findings highlight critical challenges: farmers' lack of digital literacy and awareness, infrastructural limitations, trust issues, institutional complexities, and perceived risks. Statistical analyses confirm the study's reliability and validity. The discussion outlines practical implications, advocating for digital literacy programs, infrastructure enhancements, trust-building measures, and institutionalstreamlining. The study's theoretical contributions provide a robust framework for future research, emphasizing the need for collaborative efforts to transform India's agricultural marketing via e-NAM.

Keywords: e-NAM platform, Agricultural marketing, Farmer adoption, Technology acceptance, Haryana.

1. **Introduction**

Agriculture is not only a primary source of employment but it is a way of life ingrained deep in millions of Indians. India is a land where the rhythms of life are synchronized with the harvest cycles. Agriculture & allied activities are the basis of livelihoods, nutrition, and economic growth (Kumar et al., 2015). However, this national lifeline faces many marketing problems in the post-harvest phase considerably impacting the prosperity of farmers and the whole economy in general. Farmers constantly face consequences due to the lack of market integration, information asymmetry, non-transparent price discovery and inefficiency of the supply chain (K. V Raju et al., 2016).

In order to treat these ailments, the Indian Government launched an e-trading platform known as Electronic National Agriculture Market or e-NAM in April 2016. This transformative step aimed to integrate market yards (mandis) fragmented across various states and create a unifiednational market accessible to all in an online format (Bisen & Kumar, 2018). e-NAM enables the market participants to trade in a virtual arrangement via online bidding system. Trading takes place online and the flow of material via the physically pre-established mandi infrastructure.

This platform is a ray of hope envisioning a win-win situation for all the stakeholders. For farmers, it promises fair crop prices, standardized quality assessment, and ultimately more farm income. Traders and buyers are promised to benefit from the increased efficiency in the supplychain and the reduced transaction cost (Chand, 2016). Its effective implementation will even benefit the consumers in form of stable prices and availability of products.

The intended aims and desired outcomes of e-NAM ultimately depend upon farmer adoption and effective implementation of this program (Suri, 2018). In India, effective implementation of any social welfare scheme has always been a formidable challenge and change management calls for timed of investigation of the problems and planning accordingly (Wanglar, 2022). As more than 8 years of this scheme have passed, it is high time to understand and diagnose the challenges in the adoption, usage and effective implementation of e-

NAM. To realize its full potential and maximize its benefits for the farming sector, it is imperative to confront the challenges that have surfaced during this period.

This scheme intends to eventually dismantle the age-old agricultural marketing practices wherefarmers can sell their produce only in nearest mandi via the inter-mediation by the arhtiyas (commission agents). e-NAM, on the other hand, is a digital platform that is anticipated to take- over the conventional trading of agricultural produce (M. S. Raju et al., 2022). This scenario represents a compelling research problem undertaken as this study. The primary objective of this explorative study is to identify, measure, categorize and understand the challenges faced during the farmer adoption and usage, and ultimately the effective implementation of the e- NAM platform in India. Despite the critical phenomenal importance of this scheme, we did notfind any previous research empirically examining the challenges in this direction via survey research and providing crucial insights for policymakers, stakeholders, and the future researchers.

We aim to fulfil this critical research gap and our research holds great significance for all the stakeholders. The remainder of this research paper is organized as follows: Section 2 provides literature review of the research on e-NAM. Section 3 presents the research design and methodology, explaining the data collection and analysis procedures. Subsequent sections present the findings, discuss their implications, and conclude the study.

2. **Literature Review**

The literature review section provides an in-depth explanation of the key aspects related to theElectronic National Agriculture Market (e-NAM) and the challenges faced by the stakeholders in implementation of this scheme. We explored the literature that sets for a better understanding of the adoption and implementation challenges in this context. The generic finding derived outof this review establishes the need for our study as we did not come across any comprehensive study that investigates challenges faced in the adoption, usage and overall implementation of the e-NAM platform in an

effective manner for realization of the desired outcomes of this scheme.

2.1 What is e-NAM?

e-NAM, which stands for Electronic National Agriculture Market, was introduced in April 2016 by the Indian government as a transformative step in agricultural marketing. It aimed to create a unified national market accessible to all farmers through an online trading platform. e-NAM enables market participants to engage in virtual trading, enhancing efficiency and reducing transaction costs while maintaining the flow of material through established mandi infrastructure.

2.2 Intentions and Desired Outcomes

The primary intention behind e-NAM is to address the challenges plaguing the Indian agricultural sector, including market fragmentation, information asymmetry, and non- transparent price discovery. The desired outcomes encompass fair crop prices, standardized quality assessment, increased farm income for farmers, and efficiency improvements for traders and buyers. Ultimately, it aims to provide consumers with stable prices and product availability.

2.3 Present Status

At the time of this study, e-NAM had been in operation for more than eight years. It was envisioned as a means to dismantle age-old agricultural marketing practices, where farmers could only sell their produce through intermediaries in nearby mandis. e-NAM, a digital platform, was intended to transform this conventional trading of agricultural produce.

2.4 Process of Usage and Implementation of the change

The process of using e-NAM involves farmers, traders, and buyers engaging in online bidding for agricultural produce. The physical exchange of goods still occurs through established mandi infrastructure, ensuring a smooth transition from traditional trading methods to the digital platform.

2.5 Challenges

e-NAM adoption and implementation have encountered

several significant challenges, which can be broadly categorized as follows:

2.5.1 Adoption Challenges

These challenges pertain to farmers' willingness and ability to adopt e-NAM. Factors such as digital literacy, awareness, and trust in the platform have been identified as adoption hurdles.

2.5.2 Infrastructural Challenges

The infrastructural challenges include issues such as the lack of refrigerated vans, inadequate storage facilities, poor rural road quality, limited internet connectivity, and insufficient technology infrastructure within the market yards.

2.5.3 Institutional Challenges

Institutional challenges encompass complexities related to policy and governance. Delays in notifications, a lack of state-level orientation to adopt and amend APMC acts, and a shortage of skilled manpower within APMCs have all been recognized as obstacles to the successful implementation of e-NAM.

3. Research Methodology

This section describes the research design, sampling, data collection and analysis techniques employed to identify and investigate the challenges faced by farmers in the adoption and usageof the e-NAM platform, as well as the overall challenges in the effective implementation of this program. To fulfil the research objectives, we adopt an exploratory research design as it iswell-suited for investigations of issues with limited previous research. In investigation of adoption and usage challenges, the survey facilitated our research needs. Although we surveyed farmers for overall implementation challenges but informal chats with subject experts, APMC board employees, mandi secretaries and survey data collection from a few well-informed and educated farmers facilitated knowledge of the implementation challenges. The research design encompasses various phases, including preliminary literature review, identification of scale items, expert review, pilot testing and instrument refinement. At last, data was analyzed and inferences were drawn.

3.1 Identification of Scale Items and the Expert Review

The process of crafting the data collection instrument began with the identification of scale items to measure the challenges associated with the adoption, usage, and effective implementation of the e-NAM platform. These scale items were drawn from an extensive literature review. It is noteworthy that despite a few studies focusing on this aspect, we did notfind any study that empirically measures the challenges faced in adoption, usage and implementation of the program and hence, the available pool of statements was limited. To ensure inclusion of statements that effectively capture all the dimensions of challenges faced in relation to e-NAM adoption and usage, we later contextualized the statements and some of these were self-constructed.

Following the primary selection of statements, an expert review was conducted. Experts in thefield of agricultural marketing particularly working for e-NAM implementation and researchers were engaged to critically evaluate the relevance and clarity of the scale items. Their insights and feedback were instrumental in refining the survey questionnaire. After the instrument underwent an iterative process of refinement, it was finalized. The questionnaire was divided into two parts: Part-A included an introduction letter to inform respondents that survey objectives were purely educational and confidentiality was ensured. It asked about demographic details and farming related questions. Part-B included the statements on a 5-point Likert scale from “strongly agree” to “strongly disagree.” The Likert scale was chosen becauseit is a widely used method of measuring attitudes and opinions. It included the items chosen after the expert review and categorized as per the literature review. All the relevant scales and related statements were included and modified according to the contextual needs of our study. The items for scale development have been drawn from previous studies either conducted in our context or focusing on the variable under consideration. A few of those studies include Jayashankar et al. (2018), Yasirandi et al. (2020) and Zawojska (2010).

3.2 Pilot Testing and Instrument Refinement

Prior to the main data collection, a pilot test was

conducted to assess the effectiveness of the survey instrument and to identify any ambiguities or issues in the questionnaire. Data collection was personally undertaken by one the researchers, who acted as an enumerator during this phase. The pilot testing phase involved data collection from 60 farmers using the developed questionnaire and as data was collected using scheduled method, we gained qualitative insights that further strengthened our instrument. These sessions not only enriched the understanding of nuanced viewpoints but also provided a platform for participants (although we surveyed thefarmers but chat sessions included other participants too) to express their thoughts in an open-ended manner. On the basis of pilot investigations and qualitative discussions with various stakeholders including supermarket collection center in-charges, managers, and farmers, six statements were eliminated from the final instrument. This was done to ensure that the final instrument was concise and only included relevant statements. As a result, a final survey instrument was developed for the final data collection and scale validation.

3.3 Data Collection & Analysis

We chose Haryana as our sampling universe and the rationale behind this choice was high degree of relevance and significance of the region as per our research objectives. The sampling technique employed was multi-stage sampling, ensuring a representative and diverse sample of 270 farmers. We randomly selected 3 districts and then 3 mandis and then in those 9 mandis data was collected from 30 farmers each. Earlier we distributed the survey and found that even if the questionnaire was made in Hindi (local language), farmers were unable to understand thequestions asked. Therefore, data collection involved face-to-face meetings with farmers by oneof the researchers acting as an enumerator in the process. This approach facilitated personal interactions, allowing for deeper insights and a comprehensive understanding of the challenges in e-NAM adoption and usage. As data was collected in a scheduled manner, the data cleaningwas not a problem except for 4 survey responses that were discarded because farmers denied to respond in between due to unknown reasons. We were ultimately left with 266 valid

responses for further analysis.

The data analysis started with the confirmation of the internal consistency and reliability of theconstructs used in the survey. Subsequently, exploratory factor analysis (EFA) was applied using SPSS 22 to identify underlying factors among the identified challenges. To ensure the validity of the measurement scales, confirmatory factor analysis (CFA) was conducted using AMOS 24.0. This two-step approach ensured the robustness of the measurement model and the relevance of the identified challenges.

Results and Findings

Sample Profile

The research was conducted on 266 farmers from Haryana, India. The profile of our farmer sample is presented in table 1. The majority of the farmers fell between the ages of 35-45 (39.5%), with similar numbers belonging to the 25-35 (38.0%) and above 45 years (21.1%) age groups, indicating various stages of their careers as farmers. Only 1.5% of the farmers were under 25 years old. In terms of education, 9% of the farmers had completed graduation, while 9% had a diploma. The majority of the farmers (58.6% - 156 farmers) had completed schooling but did not attend college. Surprisingly, 23.3% of the farmers had no formal education, indicating a relatively low level of education among the farming population in Haryana.

Table 1 Respondents' profile

		Frequency	Percentage
Age (in years)	Under 25 years	4	1.5
	25-35 years	101	38.0
	35-45 years	105	39.5
	Above 45 years	56	21.1
Education	No formal education	62	23.3
	12th	156	58.6
	Diploma	24	9.0
	Graduate	24	9.0
Landholding (in acres)	1-5 acres	129	48.5

	5-10 acres	96	36.1	
	10 acres and above	41	15.4	
Agricultural Experience (in years)	0-10	139	52.3	
	10-20	105	39.5	
	20-30	21		7.9
	Above 30	1		.4

As far as landholding is concerned, 48.5% owned farms below 5 acres, 36.1% owned farms between 5-10 acres, and the remaining 15.4% owned farms above 10 acres. In terms of agricultural experience, 52.3% had less than 10 years of experience, while 39.5%, 7.9%, and 0.4% had 10-20, 20-30, and over 30 years of experience, respectively.

Reliability Analysis

Reliability ensures that research instrument is likely to produce consistent results when the measurements are repeated under similar conditions. Reliability analysis is a necessary step inorder to establish scale validity. It is one of the primary tests that any instrument has to pass for being as usable for research and therefore it is this analysis can be used to adjudge quality of an instrument (Broadbent et al., 2006). Reliability can be strengthened by designing the questionnaire in a clearer manner so that respondents fill it unambiguously. It is empirically measured in several ways but the Cronbach's alpha is considered to be one of the best measures(Sun & Hong, 2002). We measured the reliability using the same and found that Cronbach's alpha score of the instrument is 0.808. Cronbach's alpha greater than 0.7 is deemed acceptable, greater than 0.8 is considered good, and greater than 0.9 is considered excellent (Cronbach, 1951). The results indicate that the research instrument used in the study is reliable.

Exploratory Factor Analysis

Exploratory factor analysis (EFA) is a technique used to reduce a given set of data into a smallernumber of factors based on the correlation among the items being analyzed. This process helps establish the underlying

constructs and is typically the initial step in scale development. EFA also assesses the convergent and discriminant validity of the scale using principal component analysis. In our study, we employed EFA because the scale we used was not standardized or previously tested in similar contexts. To determine the suitability of our data for factor analysis and principal component analysis (PCA), we conducted the Kaiser-Meyer Olkin (KMO) and Bartlett's test. The calculated chi-square value was 6953.826 with 741 degrees of freedom, indicating a significance level of 0.05. The KMO value of 0.864 suggests that our data is suitable for factor analysis. The EFA results and component definitions are presented in tables2 and 3, showcasing the pattern and structure of the data obtained through varimax rotation. We discovered 6 factors that accounted for 68.230 percent of the variance in explaining the predictors of participation decision of farmers towards supermarkets. Factor 1 was labelled "Infrastructural Challenges" due to the high loadings of statements such as: lacking refrigerated vans, inadequate scientific storage and warehousing, poor quality of rural road, poor internet connection, and inadequate number of computers, servers and kiosks in the market. The first factor was strong and explained 14.291 percent of the variance, with anEigen value of 5.946.

Factor 2 was designated as "Digital Literacy" due to the heavy loading of statements like: knowing how to use computers, smartphones, and tablets, navigating through hyperlinks, usinga digital platform for business use – online bidding and trading, using the internet to communicate, and knowing what and how to find information on the app. With an Eigen valueof 5.210, factor 2 stated 12.481 percent of the variation.

Factor 3 was named as "e-NAM Awareness" due to a high loading of the following items: I have good knowledge about e-NAM, I know about the schemes related to e-NAM, I know about the relevance of e-NAM, and I know there is a provision of training on this platform. E- NAM Awareness accounted for 11.773 percent of the variation and had an Eigen value of 4.551. Factor 4 was referred to as "Trust on e-NAM" because of the high loading of the following items: I do not doubt the honesty of the e-NAM portal, e-NAM is reliable and

will act in the interest of the stakeholders, and the e-NAM trading system is competent and effective.. This component stated 10.602 percent of the variance having an Eigen value of 4.375.

Factor 5 was nomenclated as “Institutional Challenges” due to the high loading with the following items: delay in notifications, lack of orientation of states to adopt to and amend theirAPMC acts for making provision for single levy in the market, and inadequate skilled manpower in the APMCs. This element signifies that it accounts for 9.560 percent of the overallvariation with an Eigen value of 3.581.

Factor 6 was nomenclated as “Perceived Risk” due to the high loading with the following items:I believe that using e-NAM is risky because the services delivered may fail to meet my expectations, and I believe that using e-NAM is risky because the services delivered maybe unsafe to use. This element signifies that it accounts for 9.521 percent of the overall variation with an Eigen value of 2.946

Descriptive Statistics

Table 2 presents the mean and standard deviation scores for the factors that act as challenges in the adoption and usage of the e-NAM platform, along with the results of EFA. After examining the statistical values for all the factors, it is evident that farmers lack awareness about the platform and the ability to use it due to low digital literacy. This highlights the importance of education, awareness, and training needs in this context. This finding is in line with the level of education among the farming community of Haryana. The mean score for the factor named e-NAM awareness is 2.0291, indicating that most farmers are unaware of this scheme. Similarly, the mean score for digital literacy is 2.1155, indicating that most respondents lack it. The mean score for the factor labelled as trust on e-NAM is 2.8361, indicating that farmers do not trust the platform considerably. This is supported by a high meanscore of 3.9053 for perceived risk, which conceptually acts as an antonym of trust. Farmers’ trust in e-NAM is near neutrality but leaning towards less trustworthiness. The aspect of infrastructural and institutional challenges is

emphasized as most respondents agree that they face these challenges, as indicated by high mean scores of both factors, i.e., 3.9619 and 3.9549,respectively.

Confirmatory Factor Analysis

The measurement model was investigated using CFA applied with the help of AMOS 24. Before delving into the relationships between the constructs in the structural model, one needs to ensure that the measurement model has the necessary construct validity and reliability (Fornell & Larcker, 1981; Ifinedo, 2006). The results of CFA confirmed all the extracted factors. Composite reliability (CR) can be used to evaluate the construct reliability and convergent validity of a measurement model. It takes a more introspective approach to total reliability and determines the regularity of the construct, including its firmness and similarity (Hair et al., 2010). If the CR value is greater than 0.7, scale reliability is sufficient (Fornell & Larcker, 1981; Nunnally & Bernstein, 1994). According to table 2, the composite reliability ofthe infrastructural challenges, digital literacy, e-NAM awareness, and trust on e-NAM, institutional challenges, and perceived risk is 0.934, 0.923, 0.891, 0.943, 0.874 and 0.900 respectively. It is concluded that overall reliability of each construct in the proposed model is greater than 0.70, indicating that all constructs measuring farmer perception have good reliability.

The convergent validity of a construct indicates the degree of item convergence (Hair et al., 2010). Convergent validity is usually tested using standardized construct loadings. High standardised construct loading values indicate that the components of the construct are important and reflective. The standardised construct loadings of the observed variables shouldbe greater than 0.50 (Hair et al., 2010). Factor loadings in table 2 were between the range of 0.669 and 0.906. As a result, convergent validity was declared to be good.

The degree to which one construct differs from another indicates discriminant validity (Hair et al., 2010). It is computed to ensure that the statement measure what it intended to measure as per the conceptualization. Discriminant validity can be analyzed using various methods. The first is the correlation coefficient between

the different pairs of constructs in the measurement model, which should be low because they are theoretically different (Trochim, 2006). This is because different sets of items are used to measure different constructs. Second is the AVE method, the average variance extracted (AVE) specifies whether the constructs in the measurement model are greater than the maximum shared variance of each construct and the square root of AVE and should be greater than the construct correlations. Table 3 reports the results of the aforesaid analysis and it demonstrates that all of the constructs in the model are independent.

Furthermore, the AVE estimates show that the individual constructs are greater than their shared variances (see table 2) and the square root of the AVE for diagonal constructs is greater than for non-diagonal constructs (see table 3). It is substantiated that discriminant validity is sound for the proposed model.

Table 2: Items Loadings, Reliability and Descriptive Statistics

Construct	Description	Standard Factor loading	Composite Reliability	Average Variance Extracted(AVE)	MaximumShared Variance (MSV)	Mean	Standard Deviation
InfrastructuralChallenges (F1)	Lacking refrigeratedvans	.863	0.934	0.641	0.021	3.9619	.75048
	Inadequate scientific storage and warehousing	.860					
	Poor quality of rural road	.847					
	Poor internet connection	.831					
	Inadequate number of computers, servers and kiosks in the market	.831					
	Involvement of tradersin the marketing of agricultural produce.	.792					

	Limited number of coldstorage	.786					
	Low market density	.781					
Digital Literacy (F2)	Knowing how to usecomputers, smartphones, and tablets	.865	0.923	0.633	0.014	2.1155	.73292
	Navigating through hyperlinks	.849					
	Using the Internet tocommunicate	.839					
	Knowing what and howto find information on the app	.820					
	Using a digital platformfor business use – online bidding and trading	.808					
	Using different sourcesof information and media devices, e.g. Internet and socialnetworks	.798					
	Participating in online chats and forums for learning and research	.796					
			0.891	0.508	0.006	2.0291	.54673
		.820					

e- I have good

NAM Awareness (F3)	knowledge about e-NAM.						
	I know about the schemes related to e- NAM.	.810					
	I know about the relevance of e-NAM.	.785					
	I know there is a provision of training onthis platform.	.784					
	I know there is a provision of online bidding.	.734					
	I am aware about the trading procedures.	.727					
	I am aware about e-NAM.	.672					
	I know that the prices ofcrops are also there on the portal.	.669					
Trust on e-NAM	I do not doubt the honesty of the e-NAM portal.	.906	0.943	0.767	0.035	2.8361	1.1601

(F4)							
	e-NAM is reliable and will act in the interest of the Stakeholders.	.903					
	The e-NAM trading system is competent and effective.	.900					
	I trust the trading procedure based on e-NAM portal.	.885					
	I trust the informationprovided by e-NAM portal.	.885					
Institutional challenges (F5)	Delay in notifications.	.850	0.874	0.538	0.014	3.9549	.49743
	Lack of orientation ofstates to adopt to andamend their APMC acts for making provision for single	.797					

	levyin the market.						
	Inadequate skilled manpower in theAPMCs.	.785					
	Limited number of trained traders to trade in the electronic platform.	.768					
	Single trading license and e-trading.	.760					
	Low literacy level of farmers.	.708					
Perceived Risk (F6)	I believe that using e-NAM is risky because the services deliveredmay fail to meet my expectations.	.859	0.900	0.643	0.035	3.9053	.75699

I believe that using e-NAM is risky becausethe services delivered maybe unsafe to use.	.841
I believe that using e-NAM is risky becausethe services provided maybe recorded and later used for taxationpurpose by the government.	.832
I believe that using e- NAM is risky because it may cause others to think less highly of me.	.824
I believe that using e- NAM is risky because the services delivered may fail to fit well withmy requirements.	.824

Source: Survey data

Table 3: Correlation Matrix and Roots of AVE's.

	F1	F2	F3	F4	F5	F6
F1	**0.801***					
F2	0.079	**0.796***				
F3	-0.052	0.059	**0.713***			
F4	0.120	0.001	-0.010	**0.876***		
F5(Insti)	0.105	-0.117	-0.075	-0.019	**0.733***	
F6(Risk)	0.144	0.024	0.074	-0.188	-0.056	**0.802***

* "The diagonal represents the square root of average variance extracted from observed variables (items)"; "The off diagonal represents correlations between constructs".
Source: Survey data

Table 4: Goodness of Fit Indicators for the Measurement Model

Model fit Index	chi-square/ Degree of freedom	CFI	GFI	NFI	TLI	RMSEA
Model	1.519	0.946	0.836	0.858	0.942	0.044

Source:
Survey data

To assess the overall validity of the model, model fit indicators such as the NFI (Normed Fit Index), GFI (Goodness of Fit Index), RMSEA (Root Mean Square Error Approximation), CFI (Comparative Fit Index), and TLI (Tucker-Lewis Index) were used (Hair et al., 2010). The goodness-of-fit metrics for the measurement model are listed in table 4. The corresponding results for the chi-square/degree of freedom (1.519), CFI (0.946), GFI (0.836), TLI (0.942), NFI (0.858), and RSMEA (0.045) are shown in table 4. All of the values were within acceptable limits. NFI, GFI, CFI, and TLI > 0.9, CMIN/DF 5, and RMSEA < 0.8 are acceptable values (Gefen et al., 2000; Gefen & Keil, 1998; Baumgartner and Homburg, 1995, Doll et al., 1994). Table 4 clearly shows that the measurement model is fit.

5. Discussion

5.1 Practical Implications and Policy Suggestions

The practical implications derived from this research offer a clear roadmap for policymakers and stakeholders aiming to enhance the adoption and implementation of the e-NAM platform in the realm of Indian agricultural marketing. One of the most glaring challenges illuminated by this study is the urgent need to bolster digital literacy and awareness among the agricultural

community. The findings underscore that a significant proportion of farmers in Haryana lack the requisite digital skills and, crucially, are uninformed about the substantial benefits that thee-NAM platform can bring. To bridge this knowledge and skill gap, policymakers and agricultural authorities should prioritize the development and rollout of digital literacy programs, coupled with extensive awareness campaigns. These initiatives must be meticulously crafted to cater to farmers of varying age groups and educational backgrounds, ensuring that each member of the farming community can confidently navigate and harness the power of the e-NAM platform.

Furthermore, the study has underscored the pivotal role of infrastructure in the success of e- NAM. Notably, infrastructural challenges such as the absence of refrigerated vans, poor rural road quality, and limited internet connectivity can severely impede the seamless operation of e-NAM. It is, therefore, imperative for policymakers to make substantial investments in upgrading and expanding the necessary physical infrastructure. Addressing these infrastructural deficits will enable e-NAM to function optimally, ensuring that products can betransported efficiently and transactions conducted seamlessly. Moreover, building trust in the e-NAM platform is paramount. The research reveals that farmers harbour reservations about trusting the platform. To mitigate this issue, policymakers and administrators should work towards enhancing the transparency, accountability, and overall fairness within the e-NAM system. Additionally, streamlining institutional support is essential. Challenges such as delaysin notifications and the lack of state orientation must be addressed to facilitate a smoother implementation process. By focusing on these practical implications, policymakers and stakeholders can work together to create an environment where the e-NAM platform can flourish and fulfil its potential as a transformative force in Indian agricultural marketing.

5.2 Theoretical Contributions and Future Research Directions

This research paper provides valuable theoretical contributions and sets the stage for future investigations

into the adoption and implementation of the e-NAM platform in Indian agricultural marketing. The development of a comprehensive theoretical framework is one of the primary theoretical contributions, covering a spectrum of critical factors, including infrastructural challenges, digital literacy, e-NAM awareness, trust in the platform, institutional hurdles, and perceived risk. This framework serves as a solid foundation for researchers aiming to delve deeper into the complexities of e-NAM adoption, both within the context of Haryana and in other regions of India. Future research endeavours can leverage this framework as a reference point, allowing for a nuanced understanding of how these factors may manifest differently across diverse geographical and socio-economic landscapes.

The exploratory factor analysis (EFA) conducted as part of this study contributes to the validation of these factors, adding a layer of robustness to the framework. This research has successfully demonstrated the relevance and applicability of these factors in the specific context of e-NAM adoption in Haryana. Subsequent research can build upon this validation, not only by expanding the scope of this framework but also by applying it to other states and regions in India to explore regional variations and trends.

Longitudinal studies offer a promising avenue for future research, allowing researchers to trackthe evolution of e-NAM adoption challenges over time. Such studies can provide invaluable insights into how the e-NAM platform develops and how farmers' perceptions and experiences change with its maturation. Comparing e-NAM with similar platforms in other countries offers another exciting avenue for research. Such comparative analyses can yield insights into international best practices, shedding light on strategies that have proven effective in other agricultural marketing contexts. Furthermore, researchers can explore user experience ingreater depth, capturing the perspectives, feedback, and pain points of both farmers and tradersactively engaged with the e-NAM platform. This user-centred approach can guide the development of improved interfaces and features, ultimately enhancing the user experience and the overall effectiveness of e-NAM.

In conclusion, this study lays the groundwork for a range of future research opportunities aimedat advancing our understanding of e-NAM adoption and its implications for Indian agricultural marketing. These research directions offer critical insights for policymakers, stakeholders, and researchers, guiding the continued growth and development of the e-NAM platform as a transformative force in the agricultural landscape.

6. Conclusion

This study highlights the critical challenges in the adoption and implementation of theElectronic National Agriculture Market (e-NAM) in Haryana, India. The key takeaway is the pressing need to address the digital literacy and awareness gap among farmers. Many in the farming community lack digital skills and remain unaware of e-NAM's potential benefits. Policymakers should focus on digital literacy programs and extensive awareness campaigns tobridge this gap. Infrastructure, often overlooked, is pivotal. Challenges like inadequate roads and limited internet connectivity hinder e-NAM's operation. Investments in infrastructure are essential for smooth transactions. Building trust in e-NAM is paramount. Transparency and accountability must be enhanced to address farmers' reservations. Institutional support shouldbe streamlined. The study's theoretical contributions include a robust framework for future research. This work sets the stage for understanding e-NAM adoption challenges in different contexts. In conclusion, this research offers practical insights for policymakers. It underscores the need for continued efforts to overcome challenges and harness the potential of e-NAM. Transforming Indian agricultural marketing requires a collaborative effort, ensuring e-NAM serves as a catalyst for change in the sector.

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