Measuring Service Quality and Farmers' Satisfaction in e-National Agricultural Market Using the SERVQUAL Model

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Abstract

Purpose : The Ministry of Agriculture, Government of India, developed the Electronic National Agriculture Market (e-NAM), an online platform that allows farmers to sell their produce throughout the nation. A total of 1,361 Agricultural Produce Market Committees (APMCs) in 23 states and 4 union territories provide e-NAM services. It has been observed that only a few markets have been implementing the e-NAM services effectively. According to a literature review, farmers do not generally accept or use the e-NAM services. This study used the SERVQUAL methodology to quantify the relationship between service quality characteristics and the farmers' e-NAM satisfaction levels.

Methodology : The SERVQUAL model was utilized to examine the association between farmers' satisfaction and SERVQUAL dimensions. Primary data were gathered from farmers who were registered participants in the Telangana and Odisha e-NAM implementation markets. Approximately 241 samples were chosen by a basic random sampling method. The path model and confirmatory factor analysis were created using AMOS software.

Findings : According to the study, farmers' satisfaction levels are largely influenced by just three SERVQUAL model dimensions: assurance, reliability, and tangibility.

Practical Implications : The Ministry of Agriculture must provide the State agriculture marketing authorities with the necessary policy guidelines in order to fortify the three highly consequential SERVQUAL dimensions in each e-NAM implementing market: Assurance (lessening of intermediaries, information of price and market conditions, assignment, grading, etc.), reliability (best price, inter-trading, e-bidding, etc.), and tangibility (computers, electronic weight, handheld machines, and restrooms).

Originality : In contrast to other studies on the e-NAM, the current study examined the relationship between the electronic National Agriculture Market's service quality aspects and farmers' satisfaction levels by building on the SERVQUAL model.

Keywords : **e-National Agriculture Market (e-NAM), farmers, SERVQUAL model, satisfaction, tangibility**

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Since 1947, many reforms and changes have taken place in the Indian agriculture sector; most of these reforms and changes have mainly focused on introducing high-yield crops or improving agricultural productivity. Notably, the government did not take reforms or initiatives for the farmers to enhance marketing opportunities. Most farmers face marketing problems in India every season (National Commission on Agriculture, 2006). Farmers have been selling their produce only to local traders/agents through Agriculture Produce Market Committees (APMCs). Farmers have missed out on fantastic marketing opportunities because of this antiquated method. Notably, the effective use of technology has transformed the global agricultural marketing landscape, but the Indian agriculture sector has remained dominated by traditional trading and marketing practices. Farmers nationwide had no access to any electronic marketplace for selling their produce. On

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April 14, 2016, the Indian government inaugurated the ambitious Electronic National Agriculture Market (e-NAM), allowing farmers to sell their produce online to processors or traders nationwide. It served as an online marketing platform intending to protect the farmers from the clutches of intermediaries and provide better marketing opportunities to the farmers. The Indian government's "Digital India" and "One Nation - One Market" efforts produced the e-NAM service. At first, eight Indian states and 21 marketplaces received the introduction of e-NAM (Bandaru, 2019). It is linked to 1,361 markets in 23 states and 4 Union Territories. The Indian government allocated ₹1,000 crores during the 2016–2017 and 2017–2018 budgets to establish software and hardware infrastructure in each market. Since the e-NAM portal's launch, 1.72 crore farmers and two lakh traders have registered to sell and buy agricultural goods nationwide. A total of 209 commodities, transparent bidding, almost ₹ 3,000 crores of direct online payments, and quality services are the key highlights of e-NAM during the last six years. Unfortunately, few markets have successfully implemented e-NAM services due to poor infrastructure (ICAR-National Academy of Agricultural Research Management, 2022). Furthermore, the literature survey reveals that the farmer's adoption and usage of the e-NAM services is low. Therefore, by utilizing the Parusuraman SERVQUAL model—which other authors have not employed—the current study aims to evaluate the relationship between e-NAM services and farmers' satisfaction. The study will support state and federal governments in effectively enacting policy reforms pertaining to adopting e-NAM nationwide.

Review of Literature

Chaudhary and Suri (2022) concluded that supply chain and marketing strategies currently used in agriculture must be changed to incorporate digitalization and e-trading. Chella Baskar and Shalendra (2022) reported that the current rate of farmers' and traders' participation in the e-NAM is low as it does not create stakeholder confidence. Raju et al. (2022) found that most farmers possess a medium level of knowledge on the functioning of the e-NAM portal. Furthermore, they concluded that farmers' participation is very low even after six years of implementation. Singh and Goyal (2020) studied the impact of e-NAM on prices and arrival of agricultural commodities in Punjab. The study concluded that there was no significant change in the price value even after implementing e-NAM, possibly due to poor participation. Singh et al. (2020) suggested that e-NAM software needs to be updated to expand the service to other Agriculture Product Market Committees (APMCs) in India. Furthermore, they recommended that there is a need to deploy IT professionals for the smooth functioning of the e-NAM service.

Kumar et al. (2020) reported that mandis are not operating as 100% online trading services due to software and hardware problems. The study suggested that software infrastructure is highly required to attract stakeholders to the online platform. Karim (2020) concluded that the quality of the service is an essential part of the online market. Furthermore, the study found that assurance is a highly influencing factor, followed by tangible and responsiveness factors in online marketing. In their study, Karthick et al. (2020) concluded that the National Agriculture Market is vital in distributing agri-products across the country. Furthermore, the study suggested increasing farmers' participation in the e-NAM portal, as most prefer local traders.

Purty and Khatua (2020) concluded that the farmers prefer the offline mode of crop selling as they are unaware of the e-NAM benefits. Kathayat (2019) stated that service quality is one of the problems in 52 mandis (markets) out of 67 mandis linked with e-NAM in Odisha. Kalamkar et al. (2019) found that most farmers and traders were not satisfied with the e-NAM service as online service takes more time in each state. Furthermore, the study suggested that APMCs must provide quick service to attract more stakeholders. Reddy (2018) concluded that e-NAM increases the competition in the agriculture market and eliminates price rigidity. Jaiprakash and Ranjit (2018) asserted that quality certification is essential to online transactions. The viability of the online platform for agriculture will depend on how successful it is, considering the low level of education among farmers. Gupta and Badal (2018) stated that India needs an inclusive, responsive, and technology-enabled agriculture market.

Furthermore, the study concluded that e-NAM positively impacts farmers' livelihoods. Sekhar and Yogesh (2018) stated that the farmers and traders in the research areas were not happy with the services provided by e-NAM. According to the study's findings, some of the main obstacles to e-NAM's effective operation are bad internet, the absence of a help desk, a shortage of computers, and issues with online payments.

Ramesh (2016) emphasized the advantages of the digital agriculture industry. The survey also indicated that uniform trading licenses should be implemented nationally. Chand (2012) stated that a virtual trading platform in agriculture requires a strong and established grading system. Srithar et al. (2016) have agreed that the e-NAM service is not up to the farmers' expectations. Furthermore, the study suggested that there should be coordination between the State and Central governments. Dey (2016) suggested that quick payment and inter-market trade are essential elements of the online agriculture market. Hamed Omar et al. (2015) concluded that reliability is an essential service quality element influencing the beneficiaries' satisfaction in the online market. Wang and Le (2015) concluded that tangibility is a key SERVQUAL element in electronic marketing. The Ezealaji and Adenegan (2014) study examined central government reforms in the Indian agriculture sector and concluded that market liberalization is necessary to increase farmers' incomes. Marzouq (2013) said that assurance is a key in the SERVQUAL dimension to satisfy customers in online-based marketing.

A thorough literature review reveals numerous researches on the e-NAM since its inception about traders' and farmers' perspectives, the influence of e-NAM on farmers' earnings, price stability via e-NAM, etc. Further, the literature survey reveals that the farmers' approach toward e-NAM is low as they have direct contracts with intermediaries. It is noted that no study focused on measuring the relationship between the service quality of e-NAM and farmers' satisfaction using the SERVQUAL model. Therefore, the present study focused on measuring the service quality of e-NAM using the SERVQUAL model.

Methodology and Measurement

Analytical research is being done in this research. I used the SERVQUAL (service quality) model developed by Parasuraman et al. (1985) to determine the correlation between the e-NAM service quality and farmer satisfaction. Table 2 displays the SERVQUAL dimensions that Parasuraman et al. (1985) recommended. The proposed model for the research framework is shown in Figure 1, and the narration of the dimensions is mentioned in Table 1. This framework illustrates the suggested relationship between farmers' satisfaction and SERVQUAL aspects.

Figure 1. ***Proposed Research Model of the Study***

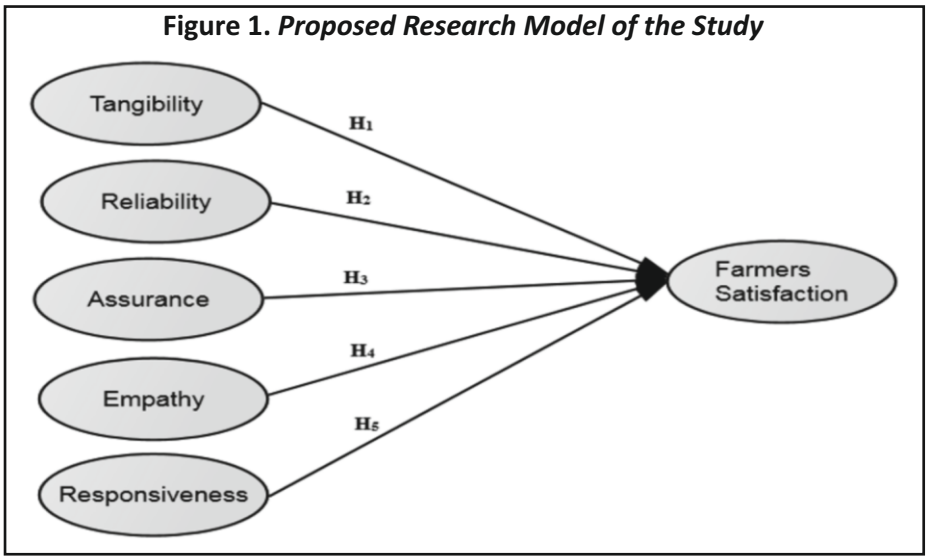


Table 1. ***Concepts and Definitions***

Concept	Definition
Tangibility	It includes equipment, physical facilities, and the presence of personnel in the online agriculture market.
Reliability	It is the capacity to complete potential service through e-NAM consistently and precisely.
Assurance	The capacity of governments to foster confidence and trust in e-NAM about fair trade, minimum supportive price, etc.
Responsiveness	It is the readiness to put the interests of the farmers first and provide timely service, payment, etc.
Empathy	e-NAM offers the highest level of care and individualized attention.

Table 2. ***SERVQUAL Dimensions and Sub-Variables***

Tangibility	Computers are modern-looking.
	Weight machines/handheld machines are good.
	Facilities are visually appealing in the market.
	Professionally skilled employees.
	Enough restrooms and godowns are available.
Reliability	Confidential e-bidding.
	Better price through e-NAM.
	Quick payment of money.
	Intertrading through e-NAM.
	Participation of organizational buyers.
Assurance	Assurance on grading/assignment.
	Reduction of intermediaries.
	Market price information and quantity arrival in close mandis.
	Quick payment system.
	Selling through e-NAM should be trustworthy.
	Access to more markets and buyers.
Empathy	No Hamali expenses and assigning service.
	Reducing quality parameters.
	The choice to accept or reject the bid.
	Education about the usage of e-NAM.
Responsiveness	Prompt response from employees.
	Analysis of price trends, arrival, and trading activities.
	Once the auction is completed, farmers are informed.
	Traders' information is available in the market.
	Farmers can view a lot of information.
Farmers' Satisfaction	A very desirable element influencing contentment is tangibility.
	One of the most desirable elements influencing pleasure is reliability.
	Assurance is a highly preferable factor contributing to satisfaction.
	Empathy is a highly preferable factor contributing to satisfaction.
	Responsiveness is a highly preferable factor contributing to satisfaction.

Objective of the Study

- To assess the SERVQUAL model's link between e-NAM service quality and farmers' satisfaction.

Hypotheses

- **H_{01} :** There is no impact of tangibility elements of e-NAM on farmers' satisfaction.
- **H_{02} :** There is no impact of reliability on farmers' satisfaction.
- **H_{03} :** There is no impact of assurance on farmers' satisfaction.
- **H_{04} :** There is no impact of empathy on farmers' satisfaction.
- **H_{05} :** There is no impact of responsiveness on farmers' satisfaction.

Methodology

Data Collection and Sample Size

The present study is based on primary data collected directly from the respondents. The sample units are registered farmers on the e-NAM portal in Telangana and Odisha, respectively (refer to Table 3). Primary data from the farmers were collected through the questionnaire method from identified markets in both states. Likert scale is used to measure the questionnaire instruments. As the population size is known, the study adopted a "simple random sampling technique" to select the respondents, and the total sample size is 241. A total of 241 respondents were proportionately distributed based on the population size of each market. The determination of sample size is based on the Yamane (1973:886) formula, as given below.

$$n = \frac{N}{1 + Ne^2}$$

It includes,

n = size of the sample,

N = Total population size (609),

e = Acceptable error, it is fixed as 5%.

Table 3. ***Kharif Season Population and Sample Size in the Markets***

State	Market Name	Population Size (Registered Farmers)	Percentage Share in Population
Odisha	Koraput	369	60.6%
Telangana	Malakpet	240	39.4%
	Total	**609**	**100%**

$$n = \frac{609}{1 + 609 \times 0.05^2}$$

which is = 241.4272 and is approximately **241.**

Therefore,

Sample respondents from Koraput Market (Odisha state) : 241 × 60.6% = **146**

Sample respondents from Malakpet Market (Telangana state) : 241 × 39.4% = **95**

Total : 241

Primary data were analyzed with the help of AMOS software. AMOS software is popular for drawing the regression model between dependent and independent variables (Byrne, 2010). Instrument reliability is essential to ensure the stability and consistency of the research. Cronbach's alpha reliability coefficient and item-to-total correlation are the best tests for consistency and dependability. Normally, Cronbach's alpha reliability range starts from zero to one, with values closer to one depicting great stability and reliability. The pilot study level reliability test findings, with a Cronbach's alpha value of 0.80, demonstrate satisfactory reliability and consistency, surpassing the 0.60 criterion (Nunnally, 1978).

Confirmatory Factor Analysis

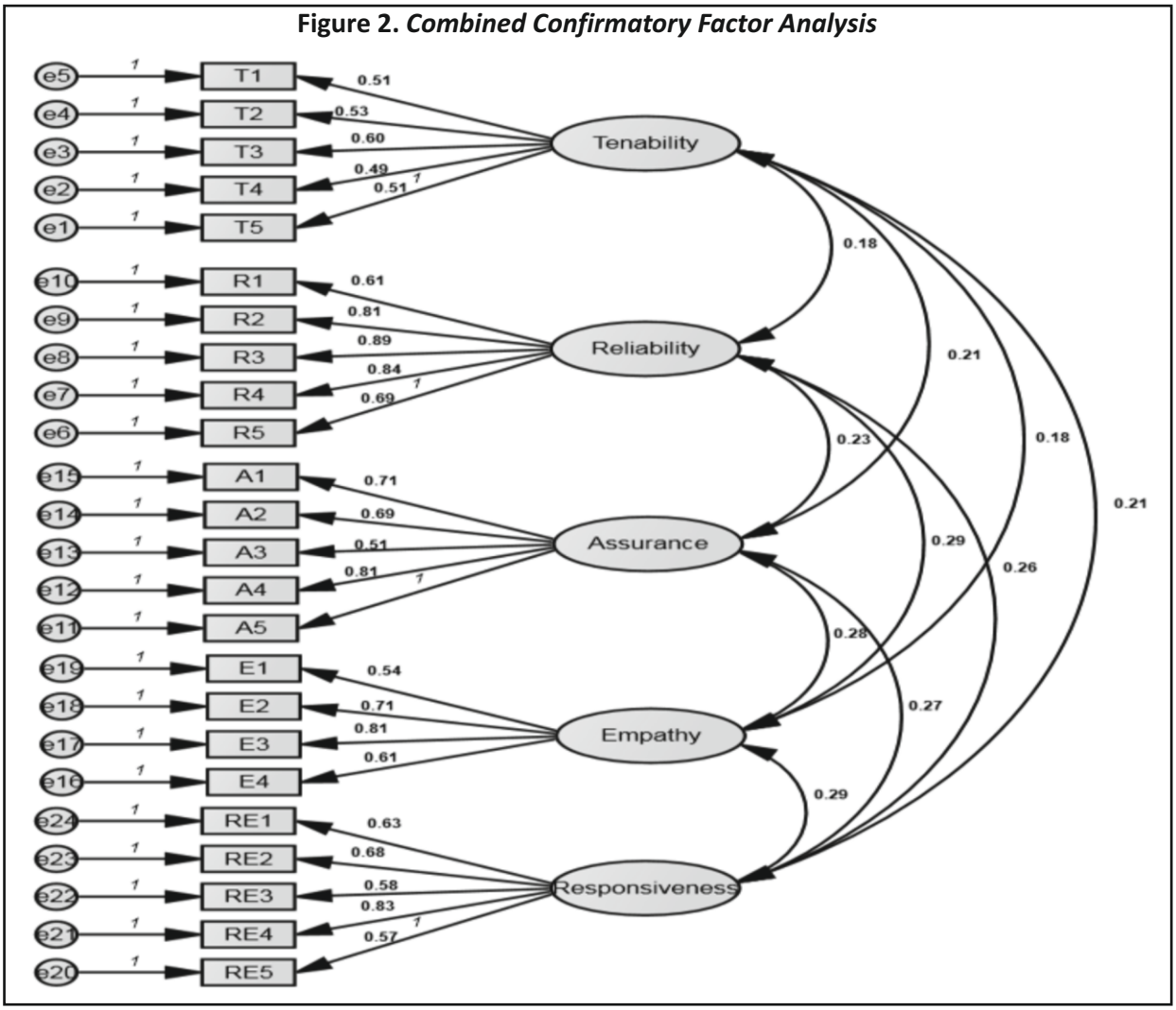
Van der Doef and Maes (1999) stated that confirmatory factor analysis (CFA) using a structural equation model (SEM) is used to measure the questionnaire's factors. As stated by Byrne (2010), the primary objective of SEM is to ascertain the degree of "fit" of the proposed model. Using the most recent version of AMOS, confirmatory analysis is performed to evaluate the validity of the survey instruments (questionnaire). The recommended model fit indices' parameters and results are shown in Table 4.

To integrate CFA across all parameters, the study used the AMOS application. AMOS software is used to perform the CFA, as seen in Figure 2. According to fit degrees recommended by several research, the CFA is measured (Byrne, 2010; Hair et al., 2006; Kline, 2011). The CFA measurement model's significant results are shown in Table 4. It provides the information that no aberrant estimates and fit indices results confirm the CFA measurement model. The research lowered the number of survey instruments from 30 to 29 following the CFA.

Table 4. ***Fit Indices of the Combined Confirmatory Factors***

Fit Indices	Results	Suggested Value
Chi-square /*DF*	2.127	< 5.00
Goodness of Fit Index (GFI)	0.899	> 0.90
Comparative Fit Index (CFI)	0.901	> 0.90
Tucker - Lewis Index (TLI)	0.911	> 0.90
Incremental Fit Index (IFI)	0.923	> 0.90
Root Mean Square Error of Approximation (RMSEA)	0.071	< 0.08
Normated Fit Index (NFI)	0.876	> 0.90
Variables before CFA	**29**	
Variables after CFA	**24**	

Figure 2. ***Combined Confirmatory Factor Analysis***



Based on the findings, the chi-square/degree of freedom (χ^2/df) value is 2.127. The model fits since the computed chi-square value is inside the extreme point, or 5.0. Furthermore, all other standard fit indices were recorded more than the deadline point 0.90, i.e., CFI = 0.901, GFI = 0.899, IFI = 0.923, and TLI = 0.911, demonstrating the model's fitness. Furthermore, it is noted that the root mean square error of approximation (RMSEA) value 0.071 is less than the standard value 0.08, which also shows a well fit of the model.

Path Model

We used the SERVQUAL model created by Parasuraman et al. (1985). According to the Parasuraman model, five dimensions of the proposed structural equation model, i.e., tangibility, reliability, assurance, empathy, and responsiveness of e-NAM service, were tested with the help of AMOS software.

After testing the questionnaire validity with the help of confirmatory factor analysis at the first level, we have prepared the structural path model to estimate the structural relationship between the SERVQUAL dimensions and farmers' satisfaction. Figure 3 shows the structural path model tested with AMOS software's help; and its estimates are revealed in Table 4. The structural path model is measured based on the adjusted goodness of fit

index (AGFI), goodness of fit index (GFI), the chi-square test, the comparative fit index (CFI), normed fit index (NFI), incremental fit index (IFI), Tucker - Lewis index (TLI), and the RMSEA value according to the outlines of previous studies (Byrne, 2010; Hair et al., 2006; Kline, 2011). Besides, the model's path coefficients were also checked for statistical significance ($p < 0.05$) and practical significance ($\beta > 0.20$). The structural model results produced enough high goodness of fit indices. It suggests that the proposed model should align with the observed data.

The structural connection measurement model was computed using several fit metrics from different authors (Byrne, 2010; Hair et al., 2006; Kline, 2011). The authors suggested the value of chi-square (χ^2), associated degrees of freedom (*df*), and at least one incremental and absolute index. The measurement model viability and significant results in Table 5 demonstrate no offending estimates. Additionally, the significant findings of the fit indices validate the maximum likelihood method's suggested model. The proposed model is fit as the chi-square/degree of freedom (χ^2/df) value of 2.931 is inside the extreme point 5.0. The results also show that the fit indices exceed the outline point of 0.90. The results indicate a good fit with the model: the GFI value is 0.931, the CFI value is 0.924, the AGFI value is 0.942, the NFI value is 0.959, the IFI value is 0.962, and the TLI value is 0.932. Ultimately, a model fit is indicated by the RMSEA value (0.056) being smaller than the cut-off value (0.08).

Table 5. ***Model Fit Indices Summary***

Fit Indices	Results	Suggested Value
Chi-square/*df*	2.931	≤ 5.00
Comparative fit index (CFI)	0.924	> 0.90
Tucker - Lewis index (TLI)	0.932	≥ 0.90
Adjusted goodness of fit index (AGFI)	0.942	> 0.90
Goodness of fit index (GFI)	0.931	> 0.90
Normed fit index (NFI)	0.959	> 0.90
Incremental fit index (IFI)	0.962	≥ 0. 90
Root mean square error of approximation (RMESA)	0.056	< 0.08

Figure 3. ***Model Standardized Estimates***

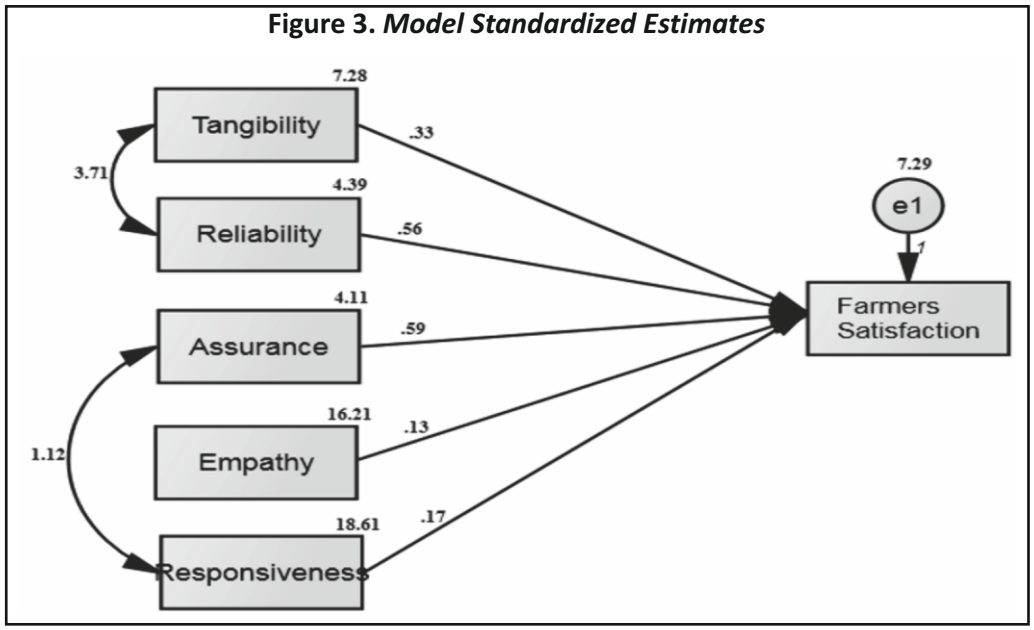


Table 6. ***Estimates of the Structural Path***

	Regression Weight	SE	CR	*p*	Remark
FS <---TAN	0.33	0.055	2.001	0.025	Positive Impact
FS <--- REL	0.56	0.045	.482	0.00	Positive Impact
FS <--- ASS	0.59	0.049	1.435	0.00	Positive Impact
FS <--- EMP	0.13	0.096	–5.660	0.230	No Impact
FS <--- RESP	0.17	0.084	3.180	0.151	No Impact

Note. *FS* = Farmers' Satisfaction ; *TAN* = Tangibility ; *REL* = Reliability ; *ASS* = Assurance ; *EMP* = Empathy ; *RESP* = Responsiveness.

Based on the hypothesized model, the path between tangibility, reliability, assurance, and farmers' satisfaction shows significant results. Table 6 shows the estimates, indicating that three dimensions, tangibility, reliability, and assurance, significantly impact farmer satisfaction at a 5% significance level. In contrast, empathy and responsiveness are not statistically significant. Therefore, the path values (i.e., farmer satisfaction to tangibility, farmer satisfaction to reliability, and farmer satisfaction to accessibility) support the significance of H_1 and H_2. Similarly, H_3, i.e., assurance to farmers' satisfaction, is also statistically significant with the standardized regression estimate of 0.059, standard error of 0.049, critical ratio of 1.435, and level of significance $p < 0.05$ (.000), supporting the structural path.

The hypothesized path model (Figure 3) shows a significant impact of e-NAM service quality on the farmers' satisfaction and fulfills all the fit indices. However, two of the dimensions are not statistically significant. The structural path between empathy for farmers' satisfaction and assurance of farmers' satisfaction has not supported the path. Hence, it is identified that the following service dimensions significantly impact farmers' satisfaction :

- Tangibility
- Reliability
- Assurance

Therefore :

$$fs = t + r + a$$

fs = farmers' satisfaction toward e-NAM,
t = tangibility,
r = reliability,
a = assurance.

Discussion

The empirical results show a significant relation between tangibility and farmers' satisfaction (H1: $\beta = 0.25$, $p < 0.05$). This result is consistent with the previous study (Lai & Quoc, 2015), which concluded that tangibility significantly impacted customer satisfaction in relation to the electronic market in Taiwan. Therefore, it is concluded that tangible factors like effective computers, electronic weighing machines, handheld machines, and restrooms are needed to satisfy and attract the farmers. As the e-NAM service is linked with several markets, there was a delay in trading due to server-related delays, unavailability of sufficient weighing machines, etc. Hence, it is suggested that the Ministry of Agriculture must focus on improving tangibility factors in e-NAM service, directly

impacting farmers' satisfaction. According to the results, the reliability factor significantly impacted farmers' satisfaction (H2: $\beta = 0.00$, $p < 0.05$). The result supports the previous finding (Hamed Omar et al., 2015) that there is a robust relationship between reliability and customer satisfaction in the e-commerce business in Norway. Therefore, it is concluded that reliability factors like best price, intertrading facility, e-bidding transparency, etc., were preferable elements to satisfy the farmers. Hence, it is suggested that the Ministry of Agriculture needs to focus on reliability factors to satisfy the farmers towards e-NAM. The result also reveals that the "assurance factor" has a significant impact on farmers' satisfaction (H3: $\beta = 0.00$, $p < 0.05$). A prior study (Marzouq, 2013) found that "assurance" (i.e., fewer middlemen, price and market conditions information, assignment, grading, etc.) significantly affected consumer satisfaction in e-business, which lends credence to the findings. As a result, the Ministry of Agriculture is advised to enhance the assurance components.

Managerial and Policy Implications

The Indian Government has initiated to double the farmers' income by the end of 2024. Ministry of Agriculture felt that expanding e-NAM across the country is an important source to increase the farmers' income. It provides better prices, transparent trading, no syndication, accessibility across the country, a digital payment mechanism, etc. However, very few markets have been successfully implementing e-NAM services. Furthermore, the literature survey reveals the farmers' approach to the e-NAM service is very low. Hence, the present study attempts to measure the relation between service quality dimensions and farmers' satisfaction using the SERVQUAL model. The key results reveal that the farmers' satisfaction is significantly and positively related to tangibility ($\beta = 0.25$, $p < 0.05$), reliability ($\beta = 0.00$, $p < 0.05$), and assurance ($\beta = 0.00$, $p < 0.05$). Empathy and responsiveness dimensions have no significant relation with farmers' satisfaction. Thus, to improve performance and raise farmer satisfaction, the Ministry of Agriculture must provide policy directives to the State Agriculture Produce Marketing Authorities (APMCs) to strengthen the three highly important SERVQUAL dimensions: tangibility (computers, electronic weight, handheld machines, and restrooms); reliability (best price, intertrading, e-bidding, etc.); and assurance (reduction of intermediaries, information of price and market conditions, assignment, grading, etc.).

Limitations of the Study and Scope for Further Research

Farmers, traders, and commission agents are the stakeholders of the e-NAM. The study attempts to identify the relation between SERVQUAL dimensions and farmers' satisfaction. For that, I considered only the farmers' perception and ignored the e-NAM authorities, employees, and agents, including the traders' opinion. Therefore, there is further scope to study the relationship between SERVQUAL dimensions and traders' or commission agents' satisfaction with e-NAM.

Author's Contribution

The concept for the empirical study was created by Ramakrishna Bandaru, who also created its research design. With assistance from his research scholars, he gathered data from the two states, Telangana and Odisha. The author himself completed the analysis and interpretation parts.

Conflict of Interest

The author certifies that he has no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

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Appendix

1 : *Strongly Disagree* ; 2 : *Disagree ;* 3 : *Neutral* ; 4 : *Agree ;* 5 : *Strongly Agree*

Tangibility	Computers are modern looking.	**1**	**2**	**3**	**4**	**5**
	Weight machines/ handheld machines are good.					
	Facilities are visually appealing in the market.					
	Professionally skilled employees.					
	Restrooms/godowns are good.					
Reliability	e-NAM provides better prices.					
	Participation of other state traders.					
	Confidential e-bidding.					
	Transparent payment.					
	Participation of organizational buyers.					
Assurance	Selling through e-NAM should be trustworthy.					
	Real-time information on prices and arrival in nearby mandis.					
	Reduction of intermediaries.					
	Quick payments - will be able to build a healthy financial profile.					
	Assurance of quality-based payments.					
	Access to more markets and buyers.					
Empathy	Reduction of market fee.					
	Reducing quality parameters.					
	The choice to accept it or reject it.					
	Education about the usage of e-NAM.					
Responsiveness	Farmers are getting immediate payment.					
	Farmers can view their lot information.					
	Once the auction is completed, farmers are informed.					
	Employees are responding promptly.					
	Analysis of price trends, arrival, and trading activities.					
Farmers'	Tangibility is a highly preferable factor to satisfy.					
Satisfaction	Reliability is a highly preferable factor to satisfy.					
	Assurance is a highly preferable factor to satisfy.					
	Empathy is a highly preferable factor to satisfy.					
	Responsiveness is a highly preferable factor to satisfy.					

About the Author

Dr. Ramakrishna Bandaru is an Assistant Professor at Central University of Kerala's School of Business Studies. In numerous national and international seminars, he has received awards and recognition for having eight best papers. Additionally, he received two Silver Medals and the Best Paper Presenter Award (BBAY) from All India Commerce Conferences.