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SOCIO-ECONOMIC DETERMINANTS OF E-NAM ADOPTION AMONG AGRICULTURAL STAKEHOLDERS IN EASTERN UTTAR PRADESH

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Abstract

The present study was conducted with the objective to compare the socio-economic profile of e-NAM adopters and non-adopters among agricultural stakeholders of Eastern Uttar Pradesh. The present study was conducted in five e-NAM-registered mandis of Bahraich, Gorakhpur, Prayagraj, Sultanpur and Pratapgarh districts representing different agro-climatic zones of the region. The investigation employed an ex-post facto research design. Total 320 respondents were selected by adopting random sampling technique (Farmers, Traders, Commission Agents and Farmer Producer Organizations (FPOs)). The data was collected with the help of a structured interview schedule and analyzed by using frequency, percentage, mean and standard deviation. The results revealed significant socio-economic variations among the adopters and non-adopters of e-NAM. Adopters were younger, better educated and more economically progressive than non-adopters. 52.00 percent of the adopters in farmers were middle age group and 44.00 percent of the non-adopters were old age group. Adopters were more educated, had higher annual income, owned a smartphone, had larger land holding and market access. Similar trends were also seen among traders, commission agents and FPOs. The study concludes that education, economic status, digital access and market connectivity are important characteristics associated with participation in digital agricultural marketing platforms.

Introduction

Agriculture continues to remain the backbone of Indian economy and provides livelihood support to a large section of rural population. Efficient marketing of agricultural commodities is essential for remunerative prices to the producers and the overall performance of the agricultural sector. Recently, Government of India has promoted digitalization in agricultural marketing through various initiatives. The Electronic National Agricultural Market (e-NAM) is one of the major reforms to integrate agricultural markets and facilitate transparent price discovery, online trading and better market access to the stakeholders. Socio-economic features of stakeholders, are generally found to influence the adoption and effective utilization of agricultural innovations. The

factors like age, education, income, landholding, farming experience, access to information and communication technologies and resource availability determine the extent of participation in modern agricultural systems. Previous studies have shown that educational attainment, economic status, digital access and market exposure have significant effects on farmers' adoption of agricultural technologies and market-oriented innovations (Raju et al., 2022; Singh et al., 2023). The impact of socio-economic conditions on the adoption behavior and decision-making capacity of agricultural stakeholders in different parts of India has also been revealed (Durgapal and Upadhyay, 2022; Singh and Singh, 2024). Eastern Uttar Pradesh is an agriculturally important region having diverse agro-climatic conditions, heterogeneous farming systems and differential resource endowment among stakeholders. Despite the implementation of e-NAM in several regulated markets across the region, there are still differences in the participation of farmers, traders, commission agents and Farmer Producer Organisations (FPOs). The socio-economic characteristics associated with such participation are little known especially in the context of Eastern Uttar Pradesh. The socio-economic profile of agricultural stakeholders must be understood to design targeted interventions to strengthen participation in digital agricultural marketing systems. However, there is a dearth of studies relating to comparative assessment of e-NAM adopters and non-adopters across different stakeholder categories in Eastern Uttar Pradesh. Therefore, the present study was undertaken with the objectives to analyze and compare the socio-economic characteristics of e-NAM adopters and non-adopters among the farmers, traders, commission agents and Farmer Producer Organizations in Eastern Uttar Pradesh. The hypothesis was that there are significant socio-economic differences among adopter and non-adopter stakeholders engaged in agricultural marketing system.

Materials and Methods

The present study was conducted in Eastern Uttar Pradesh to study the socio-economic characteristics of e-NAM adopters and non-adopters from various agricultural stakeholders. The study was carried out in five e-NAM registered mandis selected from the districts of Bahraich, Gorakhpur, Prayagraj, Sultanpur and Pratapgarh representing North Eastern Plain Zone, Eastern Plain Zone and Vindhyan Zone of Eastern Uttar Pradesh. The study was conducted through an ex-post facto research design. The ex post facto design was considered suitable for the study because the respondents' adoption behavior had already occurred and could not be manipulated by the researcher. The respondents were selected through a multistage sampling procedure. Five e-NAM registered mandis were purposively selected based on the identified districts. Respondents were selected from each selected mandi by simple random method. The study covered 200 farmers (100 adopters and 100 non-adopters), 50 traders (25 adopters and 25 non-adopters), 50 commission agents (25 adopters and 25 non-adopters) and 20 Farmer Producer Organizations (10 adopters and 10 non-adopters) making a total sample size of 320 respondents. Primary data was collected through personal interviews with the help of a structured interview schedule. The schedule was framed to get information on the socio-

economic characteristics of the respondents. The variables included were age, education, annual income, marital status, caste, gender, farming or business experience, landholding, ownership of smart phone, distance from the e-NAM mandi, risk orientation, volume transacted and scale of operation of FPOs. The data collected were coded, tabulated and analyzed using appropriate descriptive statistical techniques. Descriptive statistics were used to describe and compare the socio-economic characteristics of adopters and non-adopters within the various stakeholder categories using frequency, percentage, mean, standard deviation.

Results

1. Demographic profile of Farmer

There are significant differences in age, annual income, and farming experience between e-NAM adopters and non-adopter farmers, as shown in Table 1. The majority of the adopter farmers were in the middle-age category (52.00%). On the contrary, 44.00 percent of the non-adopters were in the old-age category. The mean age of adopter farmers was 41.90 years, which was slightly lower than that of non-adopters (42.29 years), indicating relatively greater participation of economically active and progressive farmers in digital agricultural marketing. The same table shows that adopters were economically better off than non-adopters as well. Approximately three-fifths (59.00%) of adopters were in the medium-income category, and 22.00 percent were in the high-income category. In contrast, the low-income category accounted for more than two-thirds (67.00%) of non-adopters. Adopters had an average annual income of ₹1,22,500 as compared to ₹97,500 for non-adopters. The farming experience of the adopters was also comparatively low, with the majority (58.00%) falling in the medium experience category. In contrast, 55.00 percent of non-adopters had high levels of farming experience. This indicates that the relatively younger and progressive farmers were more receptive to the emerging marketing innovations.

Table 1: Distribution of Respondents According to Age, Annual Income and Farming Experience

Variable	Adopters of e-NAM			Non-Adopters of e-NAM		
	Categories	Frequency	Percentage	Categories	Frequency	Percentage
Age	Young (up to 28)	28	28.00	Young (up to 27)	32	34.00
	Middle (29-54)	52	52.00	Middle (28-56)	20	22.00
	Old (55 and above)	20	20.00	Old (57 and above)	48	44.00
	Mean		41.9	**Mean**		42.29
	SD		14.23	**SD**		15.01
Annual income	Low (up to 70,000)	19	19.00	Low (up to 50,000)	67	67.00
	Medium (70,001-174999)	59	59.00	Medium (50,001-144999)	25	25.00

	High (175000 and above)	22	22.00	High (145000 and above)	08	08.00
	Mean		1,22,500	**Mean**		97500
	SD		52,500	**SD**		47500
Experience	Low (up to 3 years	26	16.00	Low (up to 7 years	24	24.00
	Medium (4-6 years)	58	58.00	Medium (8-22 years)	21	21.00
	High (7 and above years)	16	26.00	High (23 and above years)	55	55.00
	Mean		5	**Mean**		15
	SD		2	**SD**		8

Table 2 shows the socio-economic and resource characteristics of farmer respondents. The results indicated that the education level of the adopter farmers was higher than that of the non-adopters. Almost half of the adopters had intermediate to graduate-level education, while non-adopters had much higher illiteracy. Adopters also had somewhat higher operational holdings, with a greater share being in medium and large landholding categories. One of the most significant differences between the two groups was whether or not they owned a smartphone. The smartphone possession among adopters was 98.00 percent compared to only 67.00 percent among non-adopters. Table 2 shows that adopter farmers lived closer to e-NAM mandis, which enhanced their access to market services and digital trading opportunities. The caste distribution revealed that Other Backward Classes were predominant in both groups. Males constituted the majority of the respondents in both adopters and non-adopters. Overall, the results indicated that the adopter farmers were relatively more educated, economically better-off, digitally connected, and more market-oriented than their non-adopter counterparts.

Table 2: Distribution of Respondents According to Educational, Social and Resource Characteristics

Variable	**Categories**	**Adopters of e-NAM**		**Non-Adopters of e-NAM**	
		Frequency	**Percentage**	**Frequency**	**Percentage**
Education	Illiterate	02	02.00	18	18.00
	Primary School	13	13.00	19	19.00
	Middle School	12	12.00	21	21.00
	High School	25	25.00	24	24.00
	Intermediate	26	26.00	12	12.00

	Graduation and above	22	22.00	06	06.00
Marital Status	Married	82	82.00	79	79.00
	Unmarried	18	18.00	21	21.00
Land Holding	Marginal (<1 ha)	34	34.00	46	46.00
	Small (1-2 ha)	38	38.00	36	36.00
	Medium (2-4 ha)	20	20.00	16	16.00
	Large (>4 ha)	08	08.00	02	02.00
Gender	Male	86	86.00	89	89.00
	Female	14	14.00	11	11.00
Caste	Schedule Tribe (ST)	02	02.00	03	03.00
	Schedule Caste (SC)	16	16.00	29	29.00
	Other Backward Class (OBC)	52	52.00	42	42.00
	Unreserved Class (UR)	30	30.00	26	26.00
Ownership of smartphone	Possess smartphone	98	98.00	67	67.00
	Do not possess smartphone	02	02.00	33	33.00
Distance from e-NAM	Very near (up to 10 km)	29	29.00	18	18.00
	Near (11-40 km)	46	46.00	29	29.00
	Moderate (41-79 km)	19	19.00	41	41.00
	High 80 and above km	6	06.00	12	12.00
Transportation Medium	Jeep	23	23.00	-	-
	Pick-up	10	10.00	-	-
	Tractor Trolley	46	46.00	-	-
	E-Rickshaw	18	18.00	13	13.00
	Tempo	3	3.00	57	57.00
	Bullock cart	-	-	21	21.00
	others	-	-	9	9.00

2. Demographic profile of Traders

A look at Table 3 shows the significant differences in socio-economic characteristics of adopter and non-adopter traders. More than one-half (56.00%) of the adoptive traders were in the middle age category, whereas 48.00 percent of the non-adopters were in the old age category. The economic profile of adopters was also better than that of non-adopters. The majority (52.00%) of adopter traders were in the high-income

category, while only 24.00 percent of non-adopters were in the high-income category. The average annual income of Adopters (₹1,67,500) was much higher than that of Non-Adopters (₹1,25,500). However, non-adopters showed more trading experience, indicating that traditional market participants were relatively less inclined to adopt electronic trading platforms.

Table 3: Distribution of Respondents According to Age, Annual Income and Trading Experience

Variable	Adopters of e-NAM			Non-Adopters of e-NAM		
	Categories	**Frequency**	**Percentage**	**Categories**	**Frequency**	**Percentage**
Age	Young (up to 30)	06	24.00	Young (up to 26)	08	32.00
	Middle (31-52)	14	56.00	Middle (27-51)	05	20.00
	Old (53 and above)	05	20.00	Old (52 and above)	12	48.00
	Mean		41.2	**Mean**		**38.7**
	SD		11.64	**SD**		**12.91**
Annual income	Low (up to 95000)	03	12.00	Low (up to 66000)	13	52.00
	Medium (950001-240000)	09	36.00	Medium (66001-185000)	06	24.00
	High (above 240000)	13	52.00	High (above 185000)	06	24.00
	Mean		**1,67,500**	**Mean**		125500
	SD		**72,500**	**SD**		59500
Experience	Low (up to 3 years	04	16.00	Low (up to 5 years)	13	52.00
	Medium (4-6 years)	15	60.00	Medium (6-20 years)	06	24.00
	High (7 and above years)	06	24.00	High (20 and above years)	06	24.00
	Mean		5	**Mean**		**15**
	SD		2	**SD**		**8**

The summarized findings in Table 4 also indicate considerable differences in educational and digital features. Almost one-third (32.00%) of adopter traders had graduation and above qualifications compared to only 8.00 percent among non-adopters. Adopters were also much more likely than non-adopters to own a smartphone (96.00% vs. 76.00%). The trader population also included a majority of individuals from

Other Backward Classes, similar to the farmers. In both groups, the majority of the respondents were married. The results indicate that educational attainment and access to digital resources were important in shaping participation in e-NAM among traders.

Table 4: Distribution of Respondents According to Educational, Social and Digital Characteristics

Variable	Categories	Adopters of e-NAM		Non-Adopters of e-NAM	
		Frequency	Percentage	Frequency	Percentage
Education	Illiterate	-	-	01	04.00
	Primary School	02	08.00	04	16.00
	Middle School	04	16.00	05	20.00
	High School	05	20.00	07	28.00
	Intermediate	06	24.00	06	24.00
	Graduation and above	08	32.00	02	08.00
Marital Status	Married	20	80	19	76
	Unmarried	05	20	06	24
Caste	Schedule Tribe (ST)	0	0.00	01	04.00
	Schedule Caste (SC)	05	20.00	06	24.00
	Other Backward Class (OBC)	13	52.00	12	48.00
	Unreserved Class (UR)	07	28.00	06	24.00
Ownership of smartphone	Possess smartphone	24	96.00	19	76.00
	Do not possess smartphone	01	04.00	06	24.00

3. Demographic profile of Commission Agents

Table 5 shows significant differences in the age, annual income, and experience levels of the commission agents who are adopters and non-adopters. The dominant group of adopters was the middle-age group (56.00%), while almost half (48.00%) of the non-adopters were categorized as old-age individuals. Adopters had a better economic profile. More than half (52.00%) of the adopter commission agents were in the medium income category. However, there were also quite a few non-adopters in the low-income category. The average income (annual) of adopters (₹100,000) was significantly higher than that of non-adopters (₹70,000). But levels of experience were relatively high amongst the non-adopters, reflecting the continued preference of traditional market intermediaries for traditional marketing methods.

Table 5: Distribution of Respondents According to Age, Annual Income and Marketing Experience

Variable	Adopters of e-NAM			Non-Adopters of e-NAM		
	Categories	Frequency	Percentage	Categories	Frequency	Percentage
Age	Young (up to 30)	05	20.00	Young (up to 32)	08	32.00
	Middle (31-49)	14	56.00	Middle (33-54)	05	20.00
	Old (50 and above)	06	24.00	Old (55 and above)	12	48.00
	Mean		40	**Mean**		**44**
	SD		10	**SD**		**12**
Annual income	Low (up to 50000)	03	12.00	Low (up to 40000)	12	48.00
	Medium (50001-149999)	13	52.00	Medium (40001-99999)	09	36.00
	High (150000 and above)	09	36.00	High (100000 and above)	04	16.00
	Mean		**1,00,000**	**Mean**		**70000**
	SD		**50,000**	**SD**		**30000**
Experience	Low (up to 3 years)	04	16.00	Low (up to 5 years)	10	40.00
	Medium (4-6 years)	16	64.00	Medium (6-19 years)	03	12.00
	High (7 and above years	05	20.00	High (20 and above years	12	48.00
	Mean		5	**Mean**		**12.5**
	SD		2	**SD**		**7.5**

Table 6 also shows variations in terms of education, landholding pattern, and digital accessibility among commission agents. The proportion of adopters with graduate-level and above qualifications was much higher than for non-adopters. Likewise, the medium and large landholdings categories had more adopters. Ownership of a smartphone was 92.00 percent for adopters and 84.00 percent for non-adopters. Both the categories had predominantly Other Backward Classes in their caste composition. The findings reveal that the commission agents, who were the users of e-NAM, were on average better endowed with educational, economic, and technological resources than the nonadopters.

Table 6: Distribution of Respondents According to Educational, Social and Resource Characteristics

Variable	Categories	Adopters of e-NAM		Non-Adopters of e-NAM	
		Frequency	Percentage	Frequency	Percentage
Education	Illiterate	01	04.00	04	16.00
	Primary School	03	12.00	05	20.00
	Middle School	04	16.00	06	24.00
	High School	06	24.00	05	20.00
	Intermediate	05	20.00	03	12.00
	Graduation and above	07	28.00	02	08.00
Marital Status	Married	22	88.00	20	80.00
	Unmarried	03	12.00	05	20.00
Land Holding	Marginal (<1 ha)	04	16.00	08	32.00
	Small (1-2 ha)	08	32.00	10	40.00
	Medium (2-4 ha)	09	36.00	05	20.00
	Large (>4 ha)	04	16.00	02	08.00
Gender	Male	25	100.00	25	100.00
	Female	-	-	-	-
Caste	Schedule Tribe (ST)	01	04.00	02	08.00
	Schedule Caste (SC)	04	16.00	07	28.00
	Other Backward Class (OBC)	13	52.00	12	48.00
	Unreserved Class (UR)	07	28.00	04	16.00
Ownership of smartphone	Possess smartphone	23	92.00	21	84.00
	Do not possess smartphone	02	08.00	04	16.00

4. Demographic profile of FPOs

The adopter FPOs were functioning at a much larger scale compared to the non-adopter FPOs, as is evident from Table 7: 50 percent medium and 20 percent large scale adopted FPOs. In contrast, 60.00 percent of non-adopter FPOs primarily operated on a small scale. The higher average scale of operation among the adopters depicts better organizational capability and market participation.

Table 7: Distribution of FPOs According to Scale of Operation

Variable	Adopters of e-NAM			Non-Adopters of e-NAM		
	Categories	Frequency	Percentage	Categories	Frequency	Percentage
Scale of Operation	Small (up to 50 MT)	03	30.00	Small (up to 40 MT)	06	60.00
	Medium (51-99 MT)	05	50.00	Medium (51-79 MT)	03	30.00
	Large (100 and above)	02	20.00	Large (80 and above)	01	10.00
	Mean		75	**Mean**		**60**
	SD		25	**SD**		**20**

Table 8 shows that the FPOs that adopted the technology had better attributes of operation and infrastructure in terms of resource and market linkages than the non-adopters. The adopter FPOs were more involved in medium and high volumes of agricultural commodities, while the non-adopters were mainly in the low-volume category. Adopter FPOs had relatively large cumulative landholdings and were more digitally ready. All the adopters' FPOs were equipped with computer facilities, which show their readiness for participation in electronic agriculture marketing systems. Additionally, FPOs situated closer to e-NAM mandis exhibited higher adoption rates, potentially leading to improved market access and participation. Collectively, the results indicate that organizational strength, digital infrastructure, and operational scale were significant attributes associated with e-NAM adoption by Farmer Producer Organizations.

Table 8: Distribution of FPOs According to Operational and Infrastructure Characteristics

Variable	Categories	Adopters of e-NAM		Non-Adopters of e-NAM	
		Frequency	Percentage	Frequency	Percentage
Volume Transacted	Small Less than (10 MT)	02	20.00	07	70.00
	Medium (10–100 MT)	05	50.00	03	30.00
	Large (Above 100 MT)	03	30.00	-	-
Land Holding	Marginal (up to 5 ha)	01	10.00	03	30.00
	Small (5–9 ha)	03	30.00	04	40.00
	Medium (10–19 ha)	04	40.00	02	20.00
	Large (20 and above Ha)	02	20.00	01	10.00
Ownership of computer	Possess Computer	10	100.00	-	-

	Do not possess Computer	-	-	-	-
Distance from e-NAM	Very near <10 km	02	20.00	01	10.00
	Near 10-40 km	04	40.00	02	20.00
	Moderate 40-80 km	03	30.00	05	50.00
	High >80 km	01	10.00	02	20.00
Transportation Medium	Jeep	2	20.00	-	-
	Pick-up	1	10.00	-	-
	Tractor Trolley	5	50.00	-	-
	E-Rickshaw	2	20.00	3	30.00
	Tempo	-	-	4	40.00
	Bullock cart	-	-	-	-
	others	-	-	3	30.00

Discussion

The study identified clear socio-economic differences between e-NAM adopters and non-adopters across stakeholder categories. Adopters were generally younger or middle-aged, more educated, economically better-off, and had greater access to digital technologies. These characteristics indicate that socio-economic preparedness is essential for participation in digital agricultural marketing systems. Similar findings were reported by Raju et al. (2022) and Singh et al. (2023), who observed higher adoption of digital marketing platforms among economically active and educated farmers. Education emerged as a major determinant of adoption, as it improves understanding of digital platforms, access to market information, and decision-making abilities. Durgapal and Upadhyay (2022) also reported a positive relationship between education and technology adoption. Adopters further had higher income levels, enabling greater investment in communication, transportation, and marketing activities. This supports the findings of Singh and Singh (2024), who noted that economically stronger farmers are more likely to adopt modern agricultural technologies. Digital accessibility was another significant factor, with adopters possessing greater smartphone access, facilitating participation in online trading and market information systems. Similar observations were made by Singh et al. (2023). Additionally, adopter farmers and FPOs had larger operational holdings and higher transaction volumes, indicating that resource availability enhances market participation (Malaisamy & Arun, 2024). Adopters also had better physical access to e-NAM mandis, reducing transaction costs and improving market engagement, as highlighted by Parmar and Bansal (2025). Overall, e-NAM adoption was positively associated with education, income, digital access, resource availability, and market connectivity, suggesting the need to strengthen digital literacy, technological infrastructure, and market access to expand participation in digital agricultural marketing systems.

Conflict of Interest

The authors declare that they have no known competing interests

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