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PERCEPTION AND USE OF DIGITAL TECHNOLOGIES IN FRESH TOMATO (*Solanum lycopersicum*) MARKETING IN JALINGO LOCAL GOVERNMENT AREA OF TARABA STATE, NIGERIA

Dantani Fred Inpyido * and Jechoniah Mamiso Barau

Department of Agricultural Extension and Management, College of Agriculture Science and Technology Jalingo, Taraba State.

* Corresponding Author

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ABSTRACT

This study examined the perception and use of digital technologies in fresh tomato marketing in Jalingo Local Government Area of Taraba State, Nigeria. Specifically, it described the socio-economic characteristics of tomato marketers, identified the digital technologies used in marketing activities, examined marketers' perceptions towards digital technology adoption, and tested whether perception differed among retailers, wholesalers, and marketers engaged in both wholesale and retail activities. A multistage sampling technique was employed to select 174 tomato marketers from a population of 307 marketers across eight major tomato markets. Primary data were collected using questionnaires and analysed using descriptive statistics, a five-point Likert scale, one-way Analysis of Variance (ANOVA), and Tukey's Honestly Significant Difference (HSD) post hoc test. The findings revealed that retailers earned an average monthly income of ₦165,800, compared with ₦278,600 for wholesalers and ₦316,400 for marketers engaged in both wholesale and retail activities, while access to credit remained relatively low, particularly among retailers (31.7%). Mobile phone calls (94.3%), WhatsApp (82.8%), and mobile money/bank transfer services were the most widely used digital technologies, whereas digital record-keeping (37.4%), social media advertising (29.9%), and e-commerce platforms (16.7%) recorded low adoption rates. Tomato marketers generally had a positive perception of digital technology adoption, with an overall grand mean of 4.04. Respondents agreed that digital technologies improve business transactions (4.19), communication (4.16), access to market information (4.14), and sales and profitability (4.07), but perceived digital technologies to be relatively unaffordable (3.01) and internet services unreliable (2.93). The ANOVA results showed a significant difference in perception among the three categories of marketers ($F = 12.864$, $p < 0.001$), with Tukey HSD indicating that retailers differed significantly from wholesalers and marketers engaged in both wholesale and retail activities. The study concluded that although basic digital technologies are widely adopted, advanced digital marketing tools remain underutilised due to financial and infrastructural constraints. The study recommends strengthening digital capacity-building programmes, improving access to affordable credit for digital technology acquisition, and enhancing internet infrastructure in major tomato markets.

Keywords: Digital technology adoption, Tomato marketing, perception, Digital marketing, Fresh tomato marketers, Taraba State, Nigeria

1 INTRODUCTION

Tomato (*Solanum lycopersicum*), the second largest fruit vegetable, is one of the most important horticultural crops cultivated in Nigeria and serves as a major source of income for dry-season farmers. It is widely regarded as a "poverty reduction crop" because of its contribution to household income, employment generation, food security, and nutrition (Oyesuntimi, 2023). Tomato is also valued for its high content of vitamins, minerals, antioxidants, and bioactive compounds such as lycopene, which promote human health (Ali et al., 2020). Beyond its nutritional importance, tomato production and marketing provide livelihoods for millions of farmers, traders, transporters, processors, and other actors along the value chain (Thompson et al., 2018). However, the crop is highly perishable, with a shelf life of only four to seven days under normal storage conditions, making efficient marketing essential to minimise losses.

Nigeria is one of the largest producers of tomatoes in Africa and ranks among the leading producers globally. According to the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), Nigeria produced approximately 3.73 million metric tonnes of tomatoes from about 824,000 hectares of cultivated land in 2024. Despite this high production, productivity remains constrained by poor-quality seeds, pest and disease infestations, inadequate irrigation facilities, and inefficient post-harvest handling practices (FAOSTAT, 2024; Food and Agriculture Organization [FAO], 2025). Tomatoes are among the most widely consumed vegetables in Nigeria, with annual domestic consumption estimated at about 2.3 million metric tonnes, driven by rapid population growth, urbanisation, and increasing demand for fresh and processed tomato products (Yamauchi et al., 2024).

Tomato marketing plays a vital role in food supply, employment creation, and income generation in Nigeria. However, the marketing system is characterised by perishability, seasonal price fluctuations, weak market organisation, and inefficient supply chain management (Uzomo et al., 2026). During peak production periods, excess supply often results in market glut, low prices, and high wastage, whereas scarcity during the off-season leads to sharp price increases. In addition, tomato marketing is constrained by poor transportation systems, inadequate storage facilities, lack of standard grading and packaging, weak market information systems, and the dominance of intermediaries in price determination (Adeoye et al., 2019; Osunmakinde et al., 2024).

Post-harvest losses remain one of the greatest challenges facing the Nigerian tomato value chain. The Food and Agriculture Organization estimated that about 50% of fresh tomatoes produced in Nigeria are lost before reaching consumers because of poor harvesting practices, inadequate packaging, poor transportation, insufficient cold storage facilities, and weak market linkages (Yamauchi et al., 2024). Similarly, the Federal Ministry of Agriculture and Food Security reported that Nigeria loses approximately 45% of its annual tomato harvest, equivalent to about 1.76 million metric tonnes, due to spoilage and supply chain inefficiencies (Federal Ministry of Agriculture and Food Security, 2025). These losses reduce farmers' and marketers' incomes, increase seasonal price fluctuations, limit the availability of fresh tomatoes, and increase dependence on imported processed tomato products. Consequently, improving tomato marketing through better information flow, market coordination, transportation, storage, and digital innovations has become increasingly important (Yami et al., 2025).

Recent advances in digital technologies present new opportunities for improving agricultural marketing systems. Digital technologies, including mobile phones, internet services, social media platforms, electronic payment systems, e-commerce platforms, and digital record-keeping applications, facilitate communication, access to market information, financial transactions, and business management (Ajibola et al., 2025). These technologies enable producers and marketers to communicate directly with buyers and suppliers, advertise products, obtain current market information, coordinate logistics, receive electronic payments, and reduce transaction costs. The rapid growth in mobile phone ownership and internet access across developing countries has further enhanced opportunities for digital transformation in agricultural value chains.

Digital technologies also have considerable potential to reduce post-harvest losses by improving market coordination and facilitating faster movement of produce from producers to consumers. Through mobile applications, WhatsApp, Facebook, e-commerce platforms, and digital payment systems, marketers can identify buyers, negotiate prices, arrange transportation, and complete transactions more efficiently (Morepje et al., 2024). Improved access to timely market information enables marketers to make informed business decisions, respond quickly to market changes, improve profitability, and enhance market competitiveness. In addition, digital communication channels such as social media, Short Message Service (SMS), mobile applications, and interactive voice response systems provide opportunities for market information dissemination, business advisory services, training, and extension support. However, the successful use of these technologies depends not only on their availability but also on users' awareness, skills, perceptions, and willingness to adopt them.

Although several studies have examined digital agriculture and technology adoption among farmers in Nigeria, limited attention has been given to the perception and use of digital technologies among fresh tomato marketers, particularly

in Taraba State. Most previous studies have focused on agricultural production, mechanisation, or general information and communication technology adoption, with little emphasis on digital technologies used in tomato marketing and the perceptions of different categories of marketers. This study therefore investigates the perception and use of digital technologies in fresh tomato marketing in Jalingo Local Government Area of Taraba State, Nigeria. Specifically, the study described the socio-economic characteristics of fresh tomato marketers, identified the types of digital technologies used in their marketing activities, and examined marketers' perceptions towards digital technology adoption in tomato marketing.

1.1 Hypothesis

- **Ho:** There is no significant difference in the mean perception scores of tomato marketers towards digital technology adoption among retailers, wholesalers, and marketers engaged in both wholesale and retail activities.

2 METHODOLOGY

2.1 The Study Area

The study was conducted in Jalingo Local Government Area of Taraba State, Nigeria. Jalingo, located in the North-East geopolitical zone of the country, serves as the administrative headquarters and capital of Taraba State. Historically, it was a predominantly agrarian settlement inhabited by ethnic groups such as the Jukun-Kona, Fulani, Mumuye, and Yandang, whose major occupations included farming, livestock rearing, fishing, and trading. The Local Government Area lies between latitude 8°47'N and longitude 11°09'E and has favourable climatic conditions for agricultural production, particularly the cultivation of tomatoes and other vegetables. According to the 2006 National Population Census, Jalingo Local Government Area had a population of 139,845 persons. Using the annual population growth rate of 3.2% reported by the National Bureau of Statistics, the projected population for 2025 is approximately 254,200 persons. Agriculture remains the principal economic activity, while the area's strategic location has made it an important assembly and distribution centre for fresh agricultural produce (National Population Commission, 2006; National Bureau of Statistics, 2023).

Jalingo hosts several major markets where fresh tomatoes produced within Taraba State and neighbouring states are assembled, distributed, and sold to wholesalers, retailers, and consumers. The interactions among farmers, traders, transporters, and buyers make the area an active centre for agricultural marketing and price formation. In recent years, the increasing availability of mobile phones, internet services, and other information and communication technologies (ICTs) have gradually transformed marketing activities in the area. Tomato marketers increasingly utilise digital technologies such as mobile phone calls, WhatsApp, SMS, mobile money, bank transfers, Point-of-Sale (POS) terminals, and social media platforms to communicate with customers, obtain market information, negotiate prices, and facilitate business transactions (Food and Agriculture Organization, 2022).

2.2 Sampling Procedure and Sample Size

A multistage sampling technique was employed for the selection of respondents for this study. The first stage involved the purposive selection of eight (8) major fresh tomato markets in Jalingo Local Government Area of Taraba State. The markets selected were Tashan Lau, Mayo-Goi Bus Stop, Nukkai Market, Mile Six Market, Sabon Gari Market, Kona Area, Jalingo Central Market, and Gindin Doruwa. These markets were purposively selected because they constitute the major centres for fresh tomato marketing in the study area and account for a high concentration of tomato marketing activities. A reconnaissance survey was conducted in the selected markets to identify and compile a sampling frame of tomato marketers. The survey identified a total of 307 tomato marketers comprising retailers, wholesalers, and marketers engaged in both wholesale and retail activities. The sample size for the study was determined using the Yamane (1967) sample size determination formula: Therefore, a sample size of 174 tomato marketers was used for the study. The determined sample size was proportionately allocated to each selected market using Cochran's (1977) proportionate allocation formula. The proportionate allocation of the sample is presented in Table 1. In the final stage, random sampling was used to select the required number of respondents from each market based on the proportionately allocated sample. The final sample consisted of 104 retailers, 35 wholesalers, and 35 marketers engaged in both wholesale and retail activities, giving a total of 174 respondents.

Table 1: Distribution of Sample by Marketing Category

Market	Number of Tomato Marketers	Proportionate Sample Size	Retailers	Wholesalers	Both
Tashan Lau	56	32	20	5	7
Mayo-Goi Bus Stop	17	10	8	1	1
Nukkai Market	22	12	9	1	2
Mile Six Market	31	18	12	3	3
Sabon Gari Market	43	24	13	6	5
Kona Area	19	11	8	1	2
Jalingo Central Market	78	44	22	11	11
Gindin Doruwa	41	23	12	7	4
Total	307	174	104	35	35

Source: Reconnaissance Survey and Field Survey (2026).

2.3 Sources and Type of Data

The study utilised both primary and secondary data. Primary data were collected from fresh tomato marketers in the study area using questionnaire, while secondary data were obtained from relevant journals, government publications, and reports to provide background information and support the analysis and discussion of the findings.

2.4 Methods of Data Analysis

The data were analysed using both descriptive and inferential statistics. Descriptive statistics, including frequencies, percentages and means, were used to summarise the socio-economic characteristics of the respondents, identify the types of digital technologies used in tomato marketing, and examine marketers' perceptions towards digital technology adoption using a five-point Likert scale. Inferential statistics involved the use of one-way Analysis of Variance (ANOVA) to test the formulated hypothesis, while Tukey's Honestly Significant Difference (HSD) post hoc test was employed to separate the group means where significant differences existed.

2.5 One-Way Analysis of Variance (ANOVA)

A One-Way Analysis of Variance (ANOVA) was employed to test whether there was a significant difference in the mean perception scores of tomato marketers towards digital technology adoption among retailers, wholesalers, and marketers engaged in both wholesale and retail activities. The ANOVA F-statistic is expressed as:

$$F = \frac{MS_B}{MS_W} \text{-----(1)}$$

where:

- F = ANOVA test statistic
- MS_B = Mean Square Between Groups
- MS_W = Mean Square Within Groups

The mean squares are computed as:

$$MS_B = \frac{SS_B}{K-1} \text{-----(2)}$$

$$MS_W = \frac{SS_W}{N-K} \text{-----(3)}$$

where:

- SS_B = Sum of Squares Between Groups
- SS_W = Sum of Squares Within Groups
- k = Number of groups

- N = Total number of observations

The null hypothesis was rejected when the probability value (p) was less than or equal to the 5% level of significance ($\alpha = 0.05$).

2.6 Tukey's Honestly Significant Difference (HSD) Post Hoc Test

Following a significant ANOVA result, Tukey's Honestly Significant Difference (HSD) post hoc test was used to determine which pairs of group means differed significantly. The Tukey HSD statistic is expressed as:

$$HSD_{ij} = q_{\alpha, k, N-k} \sqrt{\frac{MS_W}{2} \left(\frac{1}{n_i} + \frac{1}{n_j} \right)} \quad \text{-----} (4)$$

where:

- HSD_{ij} = Honestly Significant Difference between groups i and j
- q = Studentised Range Statistic at significance level α
- MS_W = Mean Square Within Groups obtained from the ANOVA
- n_i = Sample size of group i
- n_j = Sample size of group j
- k = Number of groups
- N = Total sample size

A pair of group means was considered significantly different when the absolute difference between the two means exceeded the calculated HSD value or when the associated probability value (p) was less than 0.05.

3 RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics of the Respondents

The results in Table 2 show that tomato marketing in the study area was undertaken by both men and women, although participation differed across marketing categories. Retailing was equally dominated by males and females (50.0% each), while wholesalers (80.0%) and marketers engaged in both wholesale and retail activities (65.7%) were predominantly male, indicating that digital technology interventions should target both male and female marketers. This finding is consistent with Wahab et al. (2025), who reported that tomato marketing in Kano State was dominated by male marketers because of the larger capital requirements and the demanding nature of wholesale marketing.

The respondents were generally within the economically active age group, with mean ages of 39 years for retailers and 47 years for wholesalers and combined marketers. The largest proportion of retailers (37.5%) were aged 30–39 years, while 40.0% of wholesalers were aged 40–49 years, suggesting that most marketers possess the experience and capacity to adopt digital technologies. Similar findings were reported by Tafida et al. (2025), who found a mean age of 39 years among tomato farmers in Katsina State, indicating that economically active individuals are more likely to adopt agricultural innovations and digital technologies.

Most respondents had formal education, with 41.3% of retailers and 40.0% of combined marketers attaining secondary education, while 28.6% of wholesalers had tertiary education, indicating adequate literacy to utilise digital technologies. This agrees with the findings of Beeior et al. (2024), who reported that educational attainment significantly enhances the adoption of tomato post-harvest technologies among farmers in Benue State by improving their ability to understand and use new technologies. The majority were married, accounting for 65.4% of retailers, 82.9% of wholesalers, and 71.4% of combined marketers. The average household size was 6 persons for retailers and 8 persons for wholesalers and combined marketers, with 54.3% of wholesalers and 51.4% of combined marketers having households of 6–10 persons, providing family labour that may support business operations.

Membership in marketing associations was relatively high, particularly among wholesalers (80.0%), followed by combined marketers (71.4%) and retailers (60.6%), highlighting the potential of these associations as channels for digital technology training and information dissemination. Access to credit was generally limited, with only 31.7% of retailers, 51.4% of wholesalers, and 48.6% of combined marketers reporting access, which may constrain investment in digital technologies. This finding supports Oladejo (2025), who reported that access to credit among tomato marketers in Osun State was generally low and significantly influenced marketing performance, recommending cooperative financing to improve investment capacity. Monthly income differed across the marketing groups, with retailers earning an average of ₦165,800, wholesalers ₦278,600, and combined marketers ₦316,400. Furthermore,

42.9% of wholesalers earned between ₦200,001 and ₦300,000, while 40.0% of combined marketers earned above ₦300,000 monthly, indicating a greater financial capacity to adopt digital technologies.

Table 2: Socio-economic Characteristics of Tomato Marketers

Variable	Category	Retailers (n = 104)	Wholesalers (n = 35)	Both (n = 35)
Sex	Male	52 (50.0)	28 (80.0)	23 (65.7)
	Female	52 (50.0)	7 (20.0)	12 (34.3)
Age (years)	20–29	21 (20.2)	1 (2.9)	2 (5.7)
	30–39	39 (37.5)	8 (22.9)	9 (25.7)
	40–49	28 (26.9)	14 (40.0)	9 (25.7)
	50–59	13 (12.5)	8 (22.9)	10 (28.6)
	≥60	3 (2.9)	4 (11.4)	5 (14.3)
	Mean (Years)	39	47	47
Educational Level	No Formal Education	18 (17.3)	5 (14.3)	5 (14.3)
	Primary	25 (24.0)	8 (22.9)	4 (11.4)
	Secondary	43 (41.3)	12 (34.3)	14 (40.0)
	Tertiary	18 (17.3)	10 (28.6)	12 (34.3)
Marital Status	Single	23 (22.1)	2 (5.7)	4 (11.4)
	Married	68 (65.4)	29 (82.9)	25 (71.4)
	Divorced	6 (5.8)	2 (5.7)	2 (5.7)
	Widowed	7 (6.7)	2 (5.7)	4 (11.4)
Household Size	1–5 persons	39 (37.5)	5 (14.3)	7 (20.0)
	6–10 persons	52 (50.0)	19 (54.3)	18 (51.4)
	>10 persons	13 (12.5)	11 (31.4)	10 (28.6)
	Mean (Persons)	6	8	8
Membership of Association	Member	63 (60.6)	28 (80.0)	25 (71.4)
	Non member	41 (39.4)	7 (20.0)	10 (28.6)
Access to Credit	Access	33 (31.7)	18 (51.4)	17 (48.6)
	No access	71 (68.3)	17 (48.6)	18 (51.4)
Monthly Income (₦)	<100,000	27 (26.0)	1 (2.9)	1 (2.9)
	100,001–200,000	46 (44.2)	9 (25.7)	8 (22.9)
	200,001–300,000	24 (23.1)	15 (42.9)	12 (34.3)
	>300,000	7 (6.7)	10 (28.6)	14 (40.0)
	Mean Income (₦)	165,800	278,600	316,400

Source: Field survey, 2026. **Note:** Figures in parentheses are percentages.

3.2 Digital technologies Used by Tomato Marketers in the Study Area

The findings in Table 3 show that tomato marketers used different digital technologies in their marketing activities, although the level of adoption varied across retailers, wholesalers, and marketers engaged in both wholesale and retail activities. Mobile phone calls were the most widely used technology, with 94.3% of respondents reporting usage, including 100.0% of wholesalers and combined marketers and 90.4% of retailers, confirming their importance for business communication. WhatsApp was the second most commonly used technology (82.8%), with adoption rates of

97.1% among combined marketers, 88.6% among wholesalers, and 76.0% among retailers. Mobile money and bank transfer services were also widely utilised, particularly among combined marketers (97.1%) and wholesalers (91.4%), compared with 65.4% of retailers, indicating the growing importance of digital financial services. These findings agree with Adebayo et al. (2023), who reported that mobile phones and digital payment platforms were the most frequently used digital tools among agricultural produce marketers in Nigeria because they facilitate communication, price negotiation, and secure financial transactions.

The use of SMS/text messaging and digital weighing scales each recorded an overall adoption rate of 67.8%. SMS usage was similar across retailers (68.3%), wholesalers (68.6%), and combined marketers (65.7%), while digital weighing scales were used by 54.8% of retailers, 82.9% of wholesalers, and 91.4% of combined marketers, enhancing transaction accuracy. Point-of-Sale (POS) terminals were used by 51.7% of respondents, with higher adoption among combined marketers (80.0%) and wholesalers (71.4%) than retailers (35.6%). Facebook Marketplace and Facebook Pages were used by 47.1% of respondents, while Internet and Google search services were used by 42.0%, with adoption highest among combined marketers (68.6%) and lowest among retailers (29.8%).

The adoption of more advanced digital technologies remained relatively low. Digital record-keeping was used by only 37.4% of respondents, comprising 74.3% of combined marketers, 60.0% of wholesalers, and 17.3% of retailers. Social media advertising was adopted by 29.9% of respondents, while e-commerce platforms recorded the lowest usage (16.7%), ranging from 8.7% among retailers to 34.3% among combined marketers. These findings indicate that although communication and digital payment technologies are widely utilised, advanced digital business management and online marketing tools remain underutilised. This finding is consistent with Yamauchi et al. (2024), who found that while tomato marketers in northeastern Nigeria widely adopted basic digital communication tools, the use of more advanced digital marketing practices remained limited due to infrastructure, skills, and market-related constraints.

Table 3: Types of Digital Technologies Used by Tomato Marketers in the Study Area

Digital Technology Used	Retailers (n = 104)	Wholesalers (n = 35)	Both (n = 35)	Total
Mobile phone calls	94 (90.4)	35 (100.0)	35 (100.0)	164 (94.3)
WhatsApp	79 (76.0)	31 (88.6)	34 (97.1)	144 (82.8)
SMS/Text messaging	71 (68.3)	24 (68.6)	23 (65.7)	118 (67.8)
Mobile money/Bank transfer	68 (65.4)	32 (91.4)	34 (97.1)	134 (77.0)
Facebook Marketplace/Pages	45 (43.3)	16 (45.7)	21 (60.0)	82 (47.1)
POS (Point-of-Sale) terminals	37 (35.6)	25 (71.4)	28 (80.0)	90 (51.7)
Internet/Google search	31 (29.8)	18 (51.4)	24 (68.6)	73 (42.0)
E-commerce platforms	9 (8.7)	8 (22.9)	12 (34.3)	29 (16.7)
Digital weighing scale	57 (54.8)	29 (82.9)	32 (91.4)	118 (67.8)
Digital record-keeping (Excel/Mobile Apps)	18 (17.3)	21 (60.0)	26 (74.3)	65 (37.4)
Social media advertising	22 (21.2)	12 (34.3)	18 (51.4)	52 (29.9)

Source: Filed Survey, 2026. **Note:** Figures in parentheses are percentages.

3.3 Marketers' Perceptions towards Digital Technology Adoption in Tomato Marketing

The findings in Table 4 revealed that tomato marketers generally had a positive perception of digital technology adoption, with an overall grand mean of 4.04. Perceptions were more favourable among marketers engaged in both wholesale and retail activities (grand mean = 4.35) and wholesalers (4.18) than retailers (3.58), indicating greater appreciation of digital technologies among larger-scale marketers.

Respondents agreed that digital technologies improve business transactions (grand mean = 4.19), enhance communication with customers and suppliers (4.16), improve access to market information (4.14), increase sales and

profitability (4.07), and reduce transaction time (4.01). They also agreed that digital technologies reduce post-harvest losses (3.79) and that they possessed adequate skills to use digital technologies (3.87). Across these indicators, wholesalers and marketers engaged in both wholesale and retail activities consistently recorded higher mean scores than retailers. For instance, communication recorded mean scores of 4.63, 4.48, and 3.92 for combined marketers, wholesalers, and retailers, respectively, while sales and profitability recorded 4.51, 4.36, and 3.81.

However, respondents disagreed that digital technologies were affordable (grand mean = 3.01) and that internet services were reliable (grand mean = 2.93), with retailers expressing the least favourable perceptions (affordability = 2.64; internet reliability = 2.48) compared with wholesalers (3.41 and 3.36) and marketers engaged in both wholesale and retail activities (3.72 and 3.65). These findings support those of Adegbite and Machethe (2023), who identified the high cost of digital technologies, poor internet connectivity, and limited digital infrastructure as major constraints to the adoption of digital technologies among agricultural value chain actors in Nigeria. Despite these challenges, respondents expressed a strong willingness to adopt more digital technologies in the future, recording the highest grand mean score of 4.26, with mean scores of 4.78 for combined marketers, 4.61 for wholesalers, and 4.02 for retailers, indicating strong potential for increased digital technology adoption.

Table 4: Marketers' Perceptions towards Digital Technology Adoption in Tomato Marketing

Perception Statement	Retailers (n = 104)	Wholesalers (n = 35)	Both (n = 35)	Grand Mean	Decision
Digital technologies improve communication with customers and suppliers.	3.92	4.48	4.63	4.16	Agree
Digital technologies increase sales and profitability.	3.81	4.36	4.51	4.07	Agree
Digital payment systems make business transactions easier.	3.98	4.54	4.69	4.19	Agree
Digital technologies reduce the time required for marketing transactions.	3.85	4.32	4.43	4.01	Agree
Digital technologies improve access to market information.	3.94	4.47	4.58	4.14	Agree
Digital technologies reduce post-harvest losses.	3.56	4.08	4.19	3.79	Agree
Digital technologies are affordable to use.	2.64	3.41	3.72	3.01	Disagree
Internet services are reliable for digital marketing.	2.48	3.36	3.65	2.93	Disagree
I possess adequate skills to use digital technologies.	3.61	4.18	4.36	3.87	Agree
I am willing to adopt more digital technologies in the future.	4.02	4.61	4.78	4.26	Agree
Grand Mean	3.58	4.18	4.35	4.04	Agree

Source: Field survey, 2026.

3.4 Test of Hypothesis

- **H₀:** There is no significant difference in the mean perception scores of tomato marketers towards digital technology adoption among retailers, wholesalers, and marketers engaged in both wholesale and retail activities.

The result of the One-Way ANOVA presented in Table 5 shows that there was a statistically significant difference in the mean perception scores of tomato marketers towards digital technology adoption among retailers, wholesalers, and marketers engaged in both wholesale and retail activities ($F = 12.864$, $p = 0.000$). Since the p-value is less than the 5% level of significance ($p < 0.05$), the null hypothesis was rejected. This implies that the perceptions of tomato marketers towards digital technology adoption differed significantly across the three categories of marketers.

Table 5: One-Way ANOVA Showing Differences in Mean Perception Scores of Marketers towards Digital Technology Adoption

Source of Variation	Sum of Squares	df	Mean Square	F-value	p-value	Decision
Between Groups	18.742	2	9.371	12.864	0.000	Reject Ho
Within Groups	123.851	171	0.724			
Total	142.593	173				

- **Decision Rule:** Reject the null hypothesis if $p \leq 0.05$; otherwise, fail to reject the null hypothesis.

The results of the Tukey HSD post hoc test presented in Table 6 identify the specific groups responsible for the significant difference observed in the One-Way ANOVA. The findings show that the mean perception scores of retailers differed significantly from those of wholesalers (mean difference = -0.60, $p = 0.000$) and marketers engaged in both wholesale and retail activities (mean difference = -0.77, $p = 0.000$). Since the probability values are less than the 5% level of significance, the differences between these groups are statistically significant. This indicates that retailers had significantly different perceptions of digital technology adoption compared with the other two categories of marketers.

However, there was no statistically significant difference between wholesalers and marketers engaged in both wholesale and retail activities (mean difference = -0.17, $p = 0.461$), as the probability value exceeded the 5% level of significance. This shows that both groups shared similar perceptions towards digital technology adoption despite the slight difference in their mean scores. The significant differences observed between retailers and the other two groups may be attributed to differences in business scale, income, access to credit, educational attainment, and exposure to digital technologies. Wholesalers and marketers engaged in both wholesale and retail activities generally conduct larger business operations and have wider customer networks, which may increase their appreciation of the benefits of digital technologies for communication, market information, digital payments, and business management. Retailers, on the other hand, often operate on a smaller scale and may face greater financial and technological constraints, which could influence their perceptions of digital technology adoption.

Table 6: Tukey HSD Post Hoc Test for Mean Perception Scores of Tomato Marketers towards Digital Technology Adoption

Comparison (I-J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	Decision
Retailers – Wholesalers	-0.60	0.11	0.000	-0.87 to -0.33	Significant
Retailers – Both	-0.77	0.11	0.000	-1.04 to -0.50	Significant
Wholesalers – Both	-0.17	0.14	0.461	-0.52 to 0.18	Not Significant

4 CONCLUSION

The study concluded that fresh tomato marketers in Jalingo Local Government Area generally had a positive perception of digital technology adoption and widely used basic digital tools such as mobile phone calls, WhatsApp, and digital payment platforms. However, the adoption of advanced digital technologies, including digital record-keeping, social media marketing, and e-commerce platforms, remained low, particularly among retailers. Limited access to credit, the high cost of digital technologies, and unreliable internet services were identified as the major constraints to adoption. The study also revealed significant differences in perceptions towards digital technology adoption among the three categories of marketers, with retailers exhibiting less favourable perceptions than wholesalers and marketers engaged in both wholesale and retail activities.

Recommendations

- Government, extension agencies, and marketing associations should provide regular training and capacity-building programmes to improve marketers' knowledge and skills in the use of digital marketing tools, with particular emphasis on retailers.
- Government and financial institutions should improve access to affordable credit and digital financing to enable marketers to acquire smartphones, digital payment systems, internet services, and other technologies required for efficient marketing.

- Government and telecommunication service providers should improve internet infrastructure and network reliability in major tomato markets to facilitate the adoption of internet-based marketing, digital business management, and e-commerce platforms.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare no conflict of interest.

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