

INFORMATION AND COMMUNICATION TECHNOLOGIES' USE EXPERTISE AND THE UTILISATION BY FRUIT VEGETABLE FARMERS IN NIGERIA

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Abstract: *Information and Communication Technologies (ICTs) are valuable tools for developing farmers' capabilities to optimise production resources. The study assessed fruit and vegetable farmers' expertise and utilisation of ICT for cucumber and watermelon production. Members of the Osun State Exotic Fruit Farmers' Group were randomly sampled (90 of 102 farmers) for the study. Data were collected using an interview schedule and analysed using descriptive statistics and multivariate regression analysis. Results reveal the farmers' mean age was 43.8±10.33 years, and two-thirds (66.67%) were male. Low proportions (19.2% and 14.81%) were good and excellent in ICT use expertise, while many (42.96%) were poor. Some (18.89%) explored social media to link high-value markets, and 16.67% searched online pages or links to learn about artificial pollination. Farmers' ICT use expertise and extent of utilisation for cucumber and watermelon production were significantly influenced by their familiarity with ICT tools ($b = 1.29$ and 1.47) and years of ICT use experience ($b = 0.09$ and 0.16), respectively, at $p \leq 0.05$ significance level. Experience and familiarity with ICT usage spurred farmers to greater proficiency and consequent increased utilisation to optimise cucumber and watermelon production. Specialised ICT training should be prioritised for farmers' capacity building in intervention programmes.*

Keywords: *ICT proficiency, Optimal production, Social media, Vegetable production*
(JEL code: O33)

INTRODUCTION

Information and Communication Technology (ICT) has brought about changes that have tremendously facilitated science, education, trade, and diverse interactions in human endeavours. The diversity of relevance and applications espoused a variety of definitions across disciplines and people. More commonly, ICT tends to be described as modern technological tools for collecting, aggregating, processing, storing, retrieving, and transmitting information such as numeric or textual data, voice or sound, images, and related media (Al-Rahmi et al., 2020). This description revolves around the devices and infrastructures that facilitate the production, processing, transfer, and use of information through digital means such as radio, television, computers, projectors, digital cameras, mobile phones, and internet media. The foremost of these, radio, remains an effective mass communication tool that is accessible and context-defined appropriate technology for agricultural information delivery to the rural fringes in many countries of sub-Saharan Africa (Balogun et al., 2020; Olanrewaju and Farinde, 2017). The experiences

provided by such pioneer ICTs opened the door for the fast infiltration of society with the later generation of ICT devices, such as computers, mobile phones, and internet media, among others.

The use of contemporary ICT has now proven its wide potential and coverage improvement among grassroots farmers (Adeyemi et al., 2023; Balogun et al., 2021). This improvement stems from its role in facilitating the primordial importance of agricultural information use as an input for production. The use of ICT is providing alternative media that facilitate necessary interactions and relationship building for researching and communicating good agricultural practices and innovations to farmers. Al-Rahmi et al. (2020) buttressed that ICT offers self-paced learning opportunities to farmers through online resources, platforms for knowledge sharing, and mobile applications offering support services relevant to farming activities. More so, the importance is unmatched in evolving and nurturing linkages for securing connections to high-level markets for farm produce as well as cost-effective input sourcing. Furthermore, financial services access is now chiefly mediated by ICT, as many

banking services, including credit procurement, are accessed through online applications and websites. This portends a medium for the financial inclusion of farmers in remote locations and their integration into the larger society, thereby benefiting from the dividends of technological, economic, and social services and product development through ICT utilisation. This is highly valuable in many African countries, such as Ethiopia and Nigeria, where the intentional uptake of ICT in farming started relatively late compared with the other sectors of their economy (Getahun, 2020; Sennuga et al., 2022; Ayim et al., 2022). As such, the trending agricultural digitalisation, as a strategic pathway for improving productivity and resilience, is poised to change the narratives of traditional farming through improved information transfer, marketing and financial exchanges, climate-smart innovations adoption, and technological inclusion, as well as access to extension and other supports (Food and Agriculture Organisation, 2022).

In recognition, studies abound on awareness and use of ICT in relation to agriculture in Nigeria (Hasan et al., 2019; Chiazoka et al., 2021; Adeyemi et al., 2023). It is established that most farmers are more familiar with traditional ICTs such as radio and television when compared with contemporary ICTs such as the Internet and cable networks (Fawole and Olajide, 2012; Sennuga et al., 2020). The literature has also shown uneven benefits of agricultural digitalisation with evidence of underlying factors of variations in infrastructure, digital literacy, socioeconomic characteristics, and institutional support systems, among others (Arangurí et al., 2025; Makinde et al., 2025; Choruma et al., 2024). However, farmers' engagement with ICT is not chiefly a function of access and availability but also of technology acceptance and use capability or behaviour. This underpins the persistence of gaps in the meaningful use of ICT amidst improving digital technologies coverage, particularly among smallholder farmers, women, and rural populations (Abdulai et al., 2023; Ngulube, 2025). Accordingly, emphasis on digital tools coverage in line with the views of the Diffusion of Innovation theory by Rogers as mechanistic for ICT adoption has given way to a shift in scholarly attention from simple measures of ICT ownership, access, and availability to emphasising digital competence or expertise and the outcomes (Nguyen and Habók, 2023; Sharp, 2023; Vuorikari et al., 2025).

To this end, exploring the framework of Experiential Learning Theory (ELT) by David Kolb (1984) to advance knowledge on farmers' use of ICT is of great value. This directs to the viewpoint of competency or expertise development, alluding to gains of prior experience with ICT. In differentiating ELT from other cognitive learning and behavioural theories, Kolb et al. (2000) assert that subjective experience, such as farmers' initial familiarity with ICTs and experience of purposes to be served, shapes usability knowledge or skill and its use. Hence, experience could be projected as a factor in the ICT use expertise of farmers and the eventual depth of use in facilitating production activities. While this framework offers a different pathway for understanding the discourse of ICT utilisation in production activities, many studies in the literature have dwelled on issues of perceived usefulness or attitudes towards use, which are closer to that hypothesised in the Technology Acceptance Model (TAM). The TAM application to ICT use identifies intrinsic

factors of perceptions about benefits and use, and these have become widely researched in studies including Yekini et al. (2019), Eweoya et al. (2021), Adesiji et al. (2024) and Kehinde and Ayanwale (2026), among others. These have produced a gamut of benefits of ICT in agriculture, especially in the timely delivery of information, increased interactions among farmers, and communication between farmers and agricultural extension workers (Obeng et al., 2019; Salam and Khan, 2020; Mishra et al., 2020). In contrast, experiential precursors to ICT use expertise as well as the outcome of utilisation remain underexplored in the literature, particularly within the developing contexts of Africa.

The consideration of this ELT approach among organised watermelon and cucumber producers in Nigeria offers a unique discussion on the ICT use expertise of farmers, as well as the effects on pragmatic utilisation in production activities. This portends addressing the limitation in the literature for explaining variations in ICT utilisation among farmers based on differences in their levels of experience and technological competence. Hence, the study addressed the following objectives:

- i. Assess the level of expertise of the farmers in ICT usage;
- ii. Examine the utilisation of ICT for watermelon and cucumber production activities.
- iii. Examine the effects of farmers' experience on ICT use, expertise and utilisation for watermelon and cucumber production

Hypothesis

The study hypothesis is stated in the null form on the link between ICT use expertise and the utilisation in production activities as follows:

There is no significant relationship between farmers' ICT use expertise and the utilisation in watermelon and cucumber production activities.

MATERIALS AND METHODS

The study area is Osun State in southwestern Nigeria. It is an inland state comprising tropical rainforest and derived savannah zones. The derived savannah zones, which favour watermelon and cucumber production, unlike the forest region, have witnessed the successful commercialisation of watermelon and cucumber production. Also, there is increasing awareness of the economic potential of the two crops available through substantial market demand. This has motivated clustered as well as fragmented production plots in the zones. Unlike common crops in the area, farmers interested in cucumber and watermelon production are obliged to learn about cultivation and management processes, in which ICT use holds immense potential. For this value, the study population is composed of commercial cucumber and watermelon farmers. Currently, many of these farmers are organised in a group registered with the government and named the Exotic Fruit Vegetable Growers Association. This group has a membership strength of 102 members. Using a simple random sampling technique, 90 farmers were sampled as a representative group of the association.

The instrument employed for the study is a structured ques-

tionnaire developed to elicit valid information on the farmers' level of expertise in using ICT and the array of uses for which ICT was employed in their production endeavours, among others. Through the identification of relevant ICT in literature and reconnaissance survey affirmation of accessibility to the farmers, the ICTs focused on are social media platforms, e-mail, web-documents and repositories, among others. The research instrument was validated for face and content validity by the Agricultural Extension and Rural Development specialists of the College of Agriculture of Osun State University, Osogbo. Their suggestions and comments were collated and used to revise the instrument to obtain a clearly focused questionnaire for the field exercise. This was administered to the sampled farmers by trained enumerators through face-to-face contact at the end of the monthly meetings of the farmers' association for the months of March and April, 2023. The 2 sessions generated a total of 90 sufficiently filled questionnaires for analysis.

The study variables comprise the socio-economic characteristics of the respondents, including production experience and ICT exposure; ICT use expertise and utilisation of ICT in watermelon and cucumber production activities. Basically, ICT use expertise was operationalised by listing a total of 9 common ICTs relevant to purposeful use in the watermelon and cucumber production context of the study area. Also, the 5-point rating scale used by Olatoye et al. (2021) for ICT proficiency skills assessment was adopted for scoring farmers' expertise level for each of the listed ICTs. This includes 5 expertise levels, viz., poor, fair, good, very good, and excellent, which were scored 1 to 5 sequentially. The respondents' scores per item were aggregated as a continuous variable for the ICT expertise.

Utilisation of ICT was also tested based on the 9 uses identified in the reconnaissance survey of relevant ICT uses in watermelon and cucumber production. A 4-point Likert scale, comprising never, rarely, sometimes, and always, was used to assess the depth of use for each of the 9 items. These were scored 0, 1, 2 and 3, respectively. The weighted mean score was computed for the description of the results per item, while the aggregate score of the items was obtained as the continuous score employed for inferential analysis.

Data elicited on the socio-economic characteristics were analysed using descriptive statistics. This comprises the use of frequency counts and percentages for categorised variables like sex, marital status, sources of farm credits and the ordinal scales of ICT use and expertise assessment. Means and standard deviations were also computed for interval variables like age and household size. The effect of experience-related variables on ICT use expertise and utilisation in production activities was assessed using multivariate regression analysis. This involved testing the actual values collated for the respondents on the number of familiar ICT, years of use of ICT, farming experience in years and average annual income as causal variables of farmers' ICT use expertise and utilisation of ICT in production activities. This was prompted to determine the effect of these indicated precursors, initially tested to be significantly correlated, on the composite scores of ICT use expertise and utilisation in production activities. Finally, ordinary linear regression was used to test the eventual influence of ICT use expertise on the utilisation in cucumber and watermelon production activities.

The explicit forms of the functions to be expressed are given as:

$$Y_{i,j} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + e$$

Where,

Y = Dependent variable

Y₁ = ICT use expertise

Y₂ = ICT utilisation in watermelon and cucumber production

X₁ = Number of familiar ICT

X₂ = Years of ICT use (persons)

X₃ = Years of farming experience

X₄ = Average annual income (₦)

e = Random error term

β₀, β₁ - β₇ = Regression coefficients

RESULTS AND DISCUSSION

Socio-economic characteristics

Results in Table 1 show that one-third of the fruit and vegetable farmers were aged between 40 and 50 years, while 35.56% were below 40 years in age. Many (67%) were males, while one-third were females, and they were mostly (80%) married individuals. These show a good representation of youth farmers, who were predominantly males with marital obligations, dominating the fruit and vegetable production in the area. The indication that male fruit and vegetable farmers constitute twice the number of females reveals a shift in the cultural dominance of women in vegetable production. As such, regarding vegetables as women's crops, this trend may no longer be valid if it continues. Also, the majority (70%) of the farmers had households with 5 to 8 people in them, and the mean household size of the farmers indicated an average of about 6 people per household. A substantial proportion (48%) of these farmers had less than 10 years of experience in fruit and vegetable production. This would be due to the evidence of the high number of young people among the farmers. These results support the findings of Jimoh et al. (2016) on cucumber farmers in the study area, who were around 41 years of age with less than 10 years of production experience and were predominantly males. More so, two-thirds (66.67% and 68.89%) indicated that they had participated in some form of ICT training and had access to farm credits, respectively. As such, many of the farmers were familiar with ICT, and this might predispose them to employ the ICT tools during their watermelon and cucumber production activities.

Table 1. Socio-economic characteristics of the farmers

Socio-economic	Frequency	Percentage	Mean±sd
Age (years)			43.8±10.33
Below 40	32	35.56	
40-50	30	33.33	
Above 50	28	31.11	
Gender			
Male	60	66.67	
Female	30	33.33	
Household sizes			5.4±1.4
0-4	24	26.67	
5-8	63	70	
9 and above	3	3.33	
Marital status			
Single	8	8.89	
Married	72	80	
Divorced	1	1.11	
Separated	4	4.44	
Widowed	5	5.56	
Farming experience (years)			16.5±4.8
0-10	43	47.78	
11-20	21	23.33	
Above 20	26	28.89	
Participated in ICT training	60	66.67	
Participation in CBO	72	80	
Accessed farm credits	62	68.89	
Farm credits sources			
Personal savings	33	36.67	
Family/friends	7	7.78	
Microfinance bank	2	2.22	
Commercial bank	36	40	
Local group cooperative	8	8.89	
Religious bodies	3	3.33	
Accessing agricultural extension services	29	32.2	

Source: Field survey, 2023

ICT Use Expertise

Results in Table 2 show that about one quarter of the farmers were proficient, excellent and good, respectively, in the use of social media messaging. While less than one-fifth (16.7%) were adjudged excellent in online video and audio lecture use, 23.3% and 24.4% had average and good levels of expertise in media usage. Close to half (47.8% and 45.6%) had poor expertise in the use of electronic library resources and use of search engines for accessing sites and links, respectively, while only 15.6% and 10%, respectively, were excellently proficient in the use of these ICT facilities. Similarly, about one-quarter (27.8%) were found to be good at accessing and using web-based documents. The majority (60% and 51.1%) of the farmers were poor users of online archives and repositories of international agricultural organisations, while only about one in every 10 people (11.1%) were excellent users of these media.

Accordingly, online/social media messaging ranked first as the ICT in which the farmers had the best expertise relative to others listed. Online video and audio lectures ranked second (2nd), electronic mail (e-mail) ranked third (3rd), World Wide Web-based documents ranked fourth (4th), and electronic and online library resources ranked fifth (5th) as the ICT facilities in which farmers had some level of expertise. These reveal that farmers were more proficient in the use of social media messaging, online video and audio lectures, as well as electronic mail (e-mail), while they were least proficient in exploring online

archives and repositories of international agricultural organisations. This emphasises the increasing popularity of social media messaging platforms with a reported increase in use by farmers for agricultural information access and agricultural marketing, among others (Adejo and Opeyemi, 2019; Inegbedion et al., 2020).

Overall, the results generally show that many of the farmers were not proficient in the use of all the listed ICTs, as shown by the fact that between 30% and 60% were indicated to be poor in terms of the use of each of the ICTs. This reveals the prevalence of poor expertise in ICT utilisation among farmers. The implication of this is that many farmers lack the adequate skills required to successfully navigate through a variety of ICT facilities for productive purposes, despite the widespread use of ICT, improved coverage and access to digital tools. This highlights a substantial gap in farmers' skills with contemporary resources that could facilitate the optimisation of watermelon and cucumber production activities.

Table 2. Distribution of farmers by the expertise of ICT usage

ICT	Poor	Fair	Average	Good	Excellent	Rank
Online/social media messaging	35.56	2.22	13.33	24.44	24.44	1 st
Online video and audio lectures/	31.11	4.44	23.33	24.44	16.67	2 nd
Electronic mail (e-mail)	37.78	10	5.33	33.33	15.56	3 rd
World Wide Web-based documents	35.56	7.78	15.56	27.78	12.22	4 th
Electronic/online library resources	47.78	7.78	3.33	15.56	23.33	5 th
Digital electronic media	42.22	6.67	34.44	17.78	8.89	6 th
Search engines for accessing sites and links	45.56	5.56	24.44	14.44	10	7 th
Online archives	51.11	16.67	12.22	8.89	11.11	8 th
Online repositories of international agricultural organisations	60	12.22	6.67	10	11.11	9 th
Average proportion	42.96	8.15	15.41	19.62	14.81	

Source: Field survey, 2023

Level of utilisation of ICTs for cucumber and watermelon production activities

The results (Table 3) show that substantial proportions (31.1% and 38.89%) of the farmers frequently (sometimes and always) utilised ICTs for obtaining information on hybrid seeds and their sources. This is indicated as the highest-ranked purpose for which the farmers employ the use of ICTs in their vegetable production prowess. Also, many (42.2%) farmers always use ICT to link up with their co-farmers to share experience on cucumber and watermelon production. Getting the procedure of the artificial pollination process for hybrid watermelon and cucumber varieties was the third ranked, as it indicated that 24.4% and 38.89% of farmers sometimes and always use ICT to this end, respectively. About 7 in every 10 farmers (68.9%) at least utilise ICT for getting information on sequential production steps and learning about production needs. This was the fourth-ranked utility of ICT by the farmers' utilisation in cucumber and watermelon production. About one-third (32.2% each) sometimes and always use ICT for obtaining information on best practices for fertiliser and agrochemicals used in cucumber and watermelon production.

While 32.2% had never used ICT for aiding knowledge of watermelon and cucumber farm management, 34.4% were found to use ICT always for this need, and it ranked the sixth

most basic utilisation of vegetable farmers. Similarly, more than one-third (35.56%) of the farmers always use ICT for securing marketing linkage, just as about a quarter (24.4%) and 27.78% always and sometimes use ICT for getting informed about cucumber and watermelon technologies. Regarding ICT use for signing up to mailing lists of organisations supporting fruit and vegetable farmers, many (42.2%) and 16.67% had never and rarely, respectively, used ICT for this, but some (27.78%) sometimes use ICT to this effect. This was indicated as the least frequent use of ICT by the farmers in the cucumber and watermelon production processes.

Based on the results, it is evident that a substantial number of the farmers were using ICT in varied forms related to cucumber and watermelon production. As such, the findings highlight the prominence of ICT use for obtaining information on hybrid seeds, networking with co-farmers for sharing production experiences, and learning about technical procedures or artificial pollination processes. This makes it clear that ICT gives farmers the opportunity to access technical support for optimised watermelon and cucumber production in Nigeria. This corroborates the recorded variety of benefits of ICT use in agricultural production as exemplified by studies like Yekini et al. (2019), Adesiji et al. (2024) and Kehinde and Ayanwale (2026).

Table 3. Level of Utilisation of the ICTs in watermelon and cucumber production

Production purposes	Never	Rarely	Always	WMS	Rank	
Obtaining information on hybrid seeds and their sources	26.67	3.33	31.11	38.89	1.82±1.2	1 st
Linking up with co-farmers to share experience on cucumber/watermelon	27.78	13.33	16.67	42.22	1.73±1.3	2 nd
Getting the procedure of the artificial pollination process for hybrid varieties	30	6.67	24.44	38.89	1.72±1.3	3 rd
Getting information on sequential production steps and needs	27.78	3.33	38.89	30	1.71±1.2	4 th
Obtaining information on best practices on fertiliser and agrochemicals use	28.89	6.67	32.22	32.22	1.67±1.2	5 th
Aiding knowledge of watermelon and cucumber farm management	32.2	7.78	25.56	34.44	1.62±1.3	6 th
Linking potential buyers/uptakers of watermelon/cucumber	27.78	18.89	17.78	35.56	1.61±1.2	7 th
Informing on the latest technologies relevant to cucumber/watermelon production	35.56	12.22	27.78	24.44	1.41±1.2	8 th
Signing up to the mailing list of organisations supporting fruit vegetable farmers	42.22	16.67	27.78	13.33	1.12±1.1	9 th

Source: Field survey, 2023

Effect of farmers' experience on ICT use expertise and utilisation for production activities

Results in Table 4 show the results of multivariate regression of experience-related factors with ICT use expertise and the utilisation for production activities by the farmers. It was shown that the number of ICTS known ($b = 1.36$ and 1.19) and the years of use ($b=0.15$ and 0.08) had a positive and significant influence on both ICT use expertise and the utilisation for production activities by the farmers, respectively. Production experience factors, namely years of production and income, were not statistically significant in relation to the expertise and utilisation of ICT by farmers. This signifies the importance of farmers' exposure to ICTs over the depth of farming experience as a predisposing factor for tapping into contemporary oppor-

tunities offered by ICTs for enhancing farmers' production capabilities. The cognitive experience developed from interacting with ICT resources is identified as fostering expertise in usage, as well as the extent of application for facilitating production activities. This means that the more conversant the farmers are with ICTs, the more their expertise and the higher the tendency for utilisation in their production activities. These results showcased ELT assertion of the process of competency development involving concrete experience build up to active experimentation or use. The finding specifies actual ICT use experience over farm production experience as the precursor of farmers expertise development and meaningful utilization of ICT in production activities.

Table 4. Results of multivariate regression of farmers' experience factors with ICT use expertise and the utilisation in production activities

	Experience Factors	b	Standard error	t	P value
ICT uses expertise	Number of familiar ICTs	1.36	0.133	10.16	0.000*
	Years of ICT use	0.152	0.0359	4.23	0.000*
	Farming experience	0.097	0.074	1.30	0.198
	Average annual income	-1.36e-06	7.50e-07	-1.81	0.704
	Constant	9.26	1.37	6.76	0.000*
ICT utilisation in production activities	Number of familiar ICTs	1.197	0.124	9.67	0.000*
	Years of ICT use	0.084	0.033	2.54	0.013*
	Production experience	0.085	0.069	1.24	0.22
	Average annual income	-8.30e-07	6.95e-07	-1.19	0.236
	Constant	3.129	1.27	2.47	0.016*

*Significant at $P \leq 0.05$.

ICT expertise: $F=89.71$, $R^2= 0.808$; ICT utilization in production $F=66.89$, $R^2= 0.759$.

Source: Own elaboration

Hypothesis test result

Results in Table 5 show that farmers' expertise in ICT is significantly related to the utilisation of ICTs in cucumber and watermelon production. This reveals that as farmers' expertise in ICT use increases, utilisation of ICT in production activities increases and vice versa. This makes the capacity for effective use of ICT imperative for the potential to employ ICT

for enhancing production activities. This result simulates that of Olanrewju et al. (2024), which indicated that the level of expertise in using ICTs translates into substantial productive use among farmers. Also, the finding reflects the causal potential of expertise improvement on actual utilisation of ICT in line with the position of ELT.

Table 5. Result of regression analysis showing the relationship between ICT use expertise and utilisation in watermelon and cucumber production

	b	t	P-value
Expertise	1.37	0.08	15.45
Constant	3.67	0.85	4.31

$F = 238.8$, $Adjusted R^2 = 0.727$, $P-value = 0.000$

Source: Own elaboration

CONCLUSION

Social media messaging, online video and audio lectures, as well as electronic mail (e-mail) were the major ICTs in which the fruit vegetable farmers had appreciable use expertise. Aside from these, the farmers generally had poor expertise, showing inadequate skills required to successfully navigate through a variety of ICT facilities for productive purposes. Yet farmers substantially use ICT for obtaining information on hybrid seeds, networking with co-farmers for sharing production experiences, and learning about technical procedures or artificial pollination processes.

Acknowledged importance of farmers' expertise of ICT use is affirmed as a mechanism opportuning access to technical support for optimised production of watermelon and cucumber in Nigeria in line with the ELT approach. Critically, the cognitive impact of experiences accumulated from interacting with ICTs rather engagement in horticultural production foster ICT use expertise as well as the consequent extent of application for facilitating production activities. This portends significant direction for scholarly debates on the viability of experiential approach to effective ICT use and the promotion in maximising the potential in transforming fruit vegetable production.

Recommendations

1. Fruit vegetable farmers groups should be sensitised to prioritise self-help ICT appreciation training for their members.

2. Osun State Agricultural Development Programme (OSSADEP) should mandate agricultural extension officers to exemplify the potentials of varieties of ICTs through extension programmes and scheduled activities with farmers to enhance farmers' familiarity and consequent adoption of the ICT tools for production purposes.

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