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FARMERS' E-READINESS AND ICT TOOL ACCESSIBILITY IN DIGITAL AGRICULTURE: EVIDENCE FROM CHENGALPATTU DISTRICT

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ABSTRACT
This study, conducted in 2025, assessed the e-readiness of farmers and their accessibility to information and communication technology (ICT) tools within digital agricultural information systems in Chengalpattu district of Tamil Nadu. Data were collected from 120 randomly selected farmers using a pre-tested structured interview schedule. Correlation and multiple regression analyses examined the relationship between six independent variables age, education, annual income, social participation, mass media exposure, and extension contact — and farmers' accessibility to major ICT tools. Education ($r = 0.257$) and mass media exposure ($r = 0.261$) showed significant positive correlations with ICT accessibility at the 1 per cent level. Multiple regression analysis indicated that social participation ($b = 1.869$, $t = 2.264$) and mass media exposure ($b = 3.024$, $t = 2.59$) were significant positive predictors, with all six variables together explaining 76.5 per cent of the variance ($R^2 = 0.765$, $F = 2.369$). Poor network connectivity, insufficient time, and language difficulty were identified as the leading barriers to ICT utilization. The study concluded that targeted digital literacy interventions, mass media dissemination, and community-based social participation frameworks were needed to strengthen farmers' e-readiness.

KEYWORDS: E-readiness, Digital agriculture, ICT utilization, Information systems, Digital literacy, Chengalpattu, Extension contact.

INTRODUCTION
The agricultural sector in India is undergoing a digital transformation driven by Information and Communication Technologies (ICTs) that are reshaping farming practices, economic decision making, and knowledge exchange. Digital agricultural information systems, encompassing mobile-based advisory services, e-NAM platforms, soil health card portals, and precision agriculture applications, are increasingly positioned as critical enablers of sustainable agricultural development (FAO, 2023). These systems provide real-time access to weather forecasts, market intelligence, input availability, and direct benefit transfer schemes such as PM-KISAN, thereby empowering farmers with actionable information for crop planning and resource optimization (Kumar, 2025; Shukla et al., 2024).

Tamil Nadu, with its diversified agro-climatic zones and intensive farming systems, offers a compelling context for examining the intersection of digital technologies and agricultural extension. Chengalpattu district, located in the northeastern coastal region of the state, is characterized by irrigated paddy cultivation, horticultural enterprises, and peri-urban agricultural systems that are increasingly exposed to digital interventions through state-sponsored programmes and private-sector agri-tech initiatives. Despite the emphasis on digital agriculture under initiatives such as the Tamil Nadu Agricultural University e-extension programmes and the Agri-Intelligence Portal, the actual utilization of digital agricultural information systems among farmers remains uneven and inadequately understood (Kavaskar & Sharmila, 2020; Nirmalkar et al., 2022).

E-readiness, defined as the preparedness and capability of individuals to adopt and utilize digital technologies effectively, is a foundational prerequisite for the successful uptake of digital agricultural information systems. For farmers, this encompasses not only the physical accessibility of ICT devices but also the cognitive capacity to navigate digital platforms, interpret data-driven recommendations, and integrate digital information into farm management decisions (Anand et al., 2022; Patra et al., 2020). The extent of ICT tool utilization, ranging from basic mobile phones to smartphone applications for market linkage, serves as a measurable proxy for farmers' engagement with digital agricultural ecosystems.

Existing literature documents significant variation in ICT adoption across socio economic and demographic strata. Education, mass media exposure, extension contact, social participation, and economic status have been identified as critical determinants of farmers' accessibility to and utilization of ICT tools in agricultural contexts (Kumar et al., 2023; Mukherjee & Jha, 2024; Singh & Mathur, 2024). However, region-specific empirical evidence on farmers' e-readiness remains sparse, particularly for coastal districts such as Chengalpattu, where peri-urban dynamics and diversified cropping systems create unique information needs.

Against this backdrop, the present study was undertaken with the objectives of (i) assessing the e-readiness of farmers for digital agricultural information systems, (ii) determining the extent of ICT tool utilization among farming households, (iii) analyzing the relationship between selected socio economic and communicational variables and farmers' accessibility to major ICT tools, and (iv) identifying the key predictors influencing ICT tool accessibility through multiple regression analysis. The findings are expected to provide actionable insights for extension planners, policymakers, and agri-tech service providers seeking to enhance the inclusivity of digital agricultural information systems in Tamil Nadu and comparable contexts.

METHODOLOGY

The study was conducted in Chengalpattu district of Tamil Nadu, a region marked by proximity to Chennai, diverse cropping patterns including paddy, pulses, vegetables, and floriculture, and growing exposure to digital agriculture initiatives under state and central programmes. A total of 120 farmers constituted the sample, selected through multi-stage random sampling: three blocks were randomly selected from the district, four villages were randomly chosen from each block, and ten farmers were randomly selected from each village, yielding 120 respondents representing diverse crop categories and landholding sizes.

Six independent variables were studied age, education, annual income, social participation, mass media exposure, and extension contact. The dependent variable, accessibility to major ICT tools, was measured through a pre-tested 25 item dichotomous scale (yes = 1, no = 0) covering ownership and usage of mobile phones, smartphones, computers, television, radio, Kisan helplines, e-newsletters, and mobile agricultural applications, yielding scores from 0 to 25. e-Readiness was assessed through a separate 20 item scale measuring digital literacy, perceived usefulness, self-efficacy, and usage behaviour, with scores ranging from 0 to 60; respondents were classified into low, medium, and high e-readiness categories based on the mean and standard deviation of scores obtained.

Primary data were collected during the agricultural year 2025 through personal interviews using a pre-tested structured schedule, piloted with 15 farmers from a non-sample village. Data were coded, tabulated, and analyzed using frequency, percentage, mean, and standard deviation. Pearson's product-moment correlation determined the bivariate relationship between each independent variable and ICT accessibility, while multiple linear regression assessed their combined influence and identified significant predictors. The regression model used was $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + e$, where Y denotes accessibility to major ICT tools; X_1 to X_6 denote age, education, annual income, social participation, mass media exposure, and extension contact; b_1 to b_6 denote regression coefficients; a denotes the intercept; and e denotes the error term. Significance was tested at 5 per cent and 1 per cent levels of probability.

RESULT

The socio-economic profile of the 120 respondents indicated a mean age of 48.6 years. Educational attainment varied 35.00 per cent had completed primary education, 28.33 per cent secondary level, 20.00 per cent higher secondary, and 16.67 per cent graduate or post-graduate qualifications. The mean annual income from agricultural and allied sources was Rs. 2,84,500 (SD = Rs. 1,42,300). Social participation was moderate, with 54.17 per cent of respondents holding membership in at least one community organization, while mass media exposure was relatively high (72.50 per cent reporting daily or near-daily exposure). Extension contact was comparatively low, with only 38.33 per cent reporting monthly or more frequent interaction with extension personnel.

The distribution of farmers by e-readiness level is presented in Table 1. The mean e-readiness score was 51.46 (SD = 16.82). A majority of farmers (62.25%) exhibited a medium level of e-readiness, followed by low (19.50%) and high (18.25%) e-readiness.

Table 1. Distribution of Farmers by e-Readiness Level

S. No	e-Readiness Category	Farmers (%)
1.	Low (< 35.00)	19.50
2.	Medium (35.01–70.00)	62.25
3.	High (> 70.00)	18.25
	Total	100.00

Note: Mean e-readiness score = 51.46; SD = 16.82.

The accessibility of respondents to major ICT tools is presented in Table 2. Mobile phones were the most accessible tool (84.17%), followed by television (68.33%), radio (31.67%), smartphones with internet connectivity (28.33%), Kisan helpline services (21.67%), mobile agricultural applications (16.67%), and e-newsletters or e-literature (12.50%). Approximately 35.00 per cent of farmers used mobile phones specifically for agricultural information access.

Table 2. Accessibility of Respondents to Major ICT Tools

S. No	ICT Tool	Farmers Reporting Access (%)
1.	Mobile phone	84.17

2.	Television	68.33
3.	Radio	31.67
4.	Smartphone with internet	28.33
5.	Kisan helpline services	21.67
6.	Mobile agricultural applications	16.67
7.	e-Newsletters / e-literature	12.50

The correlation coefficients between the independent variables and respondents' accessibility to major ICT tools are presented in Table 3. Education (r = 0.257**) and mass media exposure (r = 0.261**) showed significant positive correlations with ICT accessibility at the 1 per cent level. Social participation (r = 0.174) and extension contact (r = 0.066) showed positive but non-significant correlations. Age (r = -0.011) and annual income (r = -0.026) showed negligible negative correlations, neither statistically significant.

Table 3. Correlation between Independent Variables and Accessibility to Major ICT Tools

S. No	Independent Variable	Correlation Coefficient (r)
1.	Age	-0.011
2.	Education	0.257**
3.	Annual income	-0.026
4.	Social participation	0.174
5.	Mass media exposure	0.261**
6.	Extension contact	0.066

**Significant at 1% level

Multiple regression analysis of the independent variables on ICT accessibility is presented in Table 4. The model yielded an R^2 of 0.765, indicating that the six variables together explained 76.5 per cent of the variance in ICT accessibility, with an F-value of 2.369. Social participation (b = 1.869, t = 2.264*) and mass media exposure (b = 3.024, t = 2.59*) emerged as significant positive predictors at the 5 per cent level. Education (b = 0.67, t = 1.994) approached but did not reach significance. Age (b = 0.007, t = 0.224), annual income (b = -0.031, t = -0.131), and extension contact (b = -0.253, t = -0.246) were non-significant predictors.

Table 4. Regression between Independent Variables and Accessibility to Major ICT Tools

S. No	Independent Variable	Regression Coefficient (b)	t Value
1.	Age	0.007	0.224
2.	Education	0.67	1.994
3.	Annual income	-0.031	-0.131
4.	Social participation	1.869	2.264*
5.	Mass media exposure	3.024	2.59*
6.	Extension contact	-0.253	-0.246

R^2 = 0.765; F = 2.369; *Significant at 5% level

The barriers to ICT utilization, ranked using Garrett's ranking technique, are presented in Table 5. Poor network connectivity ranked first (Garrett score = 7508; 11.98%), followed by insufficient time to use ICT tools (7485; 11.95%), difficulty understanding English (7071; 11.28%), social barriers (7032; 11.22%), lack of digital skills (6962; 11.11%), lack of awareness about agricultural applications (6831; 10.90%), lack of trust in digital information (6706; 10.70%), high cost of internet (6581; 10.50%), and gender barriers (6480; 10.34%).

Table 5. Barriers to ICT Utilization in Digital Agricultural Information Systems

S. No	Barrier	Garrett Score	Percentage	Rank
1.	Poor network connectivity	7508	11.98	1
2	Insufficient time to use ICT	7485	11.95	2
3.	Difficulty understanding English	7071	11.28	3
4.	Social barriers	7032	11.22	4
5.	Lack of digital skills	6962	11.11	5
6.	Lack of awareness about apps	6831	10.90	6
7.	Lack of trust in digital info	6706	10.70	7
8.	High cost of internet	6581	10.50	8
9.	Gender barriers	6480	10.34	9

DISCUSSION

The findings illuminate the multi-dimensional nature of farmers' e-readiness and ICT tool utilization in Chengalpattu district. Although most farmers are not entirely disconnected from technology, the predominance of the medium e-readiness category suggests that many lack the advanced skills and confidence needed to navigate complex digital platforms and integrate ICT-based information into farm management decisions. The relatively small proportion of farmers in the high e-readiness category indicates that digital agricultural information systems, in their current form, reach

only a limited segment of the farming population, while the considerable standard deviation points to heterogeneity that uniform digital literacy interventions may not adequately address.

The significant positive correlation between education and ICT accessibility aligns with the broader consensus in extension literature that formal education is a foundational enabler of digital adoption (Anand et al., 2022; Chandra et al., 2023). Educated farmers are better equipped to interpret digital interfaces and operationalize data-driven recommendations. However, the non-significance of education in the regression model suggests its effect may be mediated by mass media exposure and social participation, or attenuated by multicollinearity among the communicational variables.

Mass media exposure emerges as the most consistently significant variable across both analyses, underscoring the role of media environments in shaping farmers' awareness and readiness to engage with ICT tools for weather forecasting, market monitoring, and input procurement. This corroborates the observations of Mishra et al. (2020) and Shukla et al. (2024), who describe mass media as a cognitive priming mechanism for technology adoption in rural audiences.

The significant predictive effect of social participation highlights the role of social capital and peer networks in facilitating ICT accessibility. Farmers engaged in community organizations are exposed to collective learning environments where technology adoption is modelled by peers, consistent with Nirmalkar et al. (2022) and Lalthlamuanpuii et al. (2024). This suggests that digital agricultural information systems may benefit from community-level deployment strategies rather than purely individual-centric outreach.

The non-significance of age, income, and extension contact merits attention. The negligible age effect diverges from earlier studies reporting stronger age-related digital divides (Kumar et al., 2015; Panda et al., 2019), possibly reflecting the demographic composition of the sample or the increasing spread of mobile phones across generations. The weak income effect suggests that affordability of entry-level devices may no longer be the primary constraint; skill deficits and infrastructure limitations appear more binding, consistent with Kumar (2025). The non-significant effect of extension contacts raises questions about the digital preparedness of extension functionaries themselves, echoing Patra et al. (2020) and pointing to a need for parallel capacity-building within the extension workforce.

The regression model explains a substantial share of the variance in ICT accessibility, though close to a quarter remains attributable to unmeasured factors such as digital self-efficacy, perceived usefulness, connectivity quality, and trust in digital platforms, which future studies could usefully incorporate. The barrier analysis reinforces that infrastructural constraints, particularly network connectivity and cost, remain fundamental bottlenecks in digital agricultural diffusion (Patra et al., 2020; Nirmalkar et al., 2022), while the language barrier highlights the mismatch between farmers' linguistic profile and the predominantly English content of digital platforms, reinforcing the case for Tamil-language interfaces and low-bandwidth applications.

CONCLUSION

This study provides empirical evidence on the e-readiness of farmers and the determinants of their accessibility to digital tools within digital agricultural information systems in Chengalpattu district, Tamil Nadu. Mass media exposure and education emerge as significant correlates of technology accessibility, while social participation and mass media exposure serve as significant positive predictors in the regression framework, together explaining a substantial share of the variation observed. Poor network connectivity, insufficient time, and language difficulty stand out as the foremost obstacles to technology use among farmers. The findings challenge the assumption that economic resources and formal extension contact are the primary drivers of digital adoption, indicating instead that communicational exposure and social embeddedness exert a stronger influence. Digital agriculture initiatives should therefore prioritize information ecosystem strengthening and community-based diffusion strategies alongside infrastructure development.

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