

UTILIZATION PATTERN OF INFORMATION AND COMMUNICATION TECHNOLOGY BY THE FARMERS

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ABSTRACT

Information and Communication Technology (ICT) plays significant role in enhancing agricultural productivity and dissemination of timely information among farmers. In recent years, the use of ICT in agriculture has increased considerably due to rapid advancement in digital technologies and improved connectivity. However, their utilization pattern varies across different regions and categories of farmers, depending upon their socio-economic characteristics, level of awareness and access to technological resources. Despite the growing importance of ICT in agricultural development, there is limited understanding regarding their actual usage pattern among farmers in Punjab. Therefore, the present study was carried in Jalandhar and Tarn Taran districts of Punjab, on the basis of highest and lowest literacy rate, respectively, to analyze the utilization pattern of ICT among farmers. From each district, two blocks were selected randomly and further, 30 farmers were selected randomly from each block to make a sample size of 120 farmers. For the purpose of data collection, a well-structured interview schedule was used to ensure reliability and accuracy of information. The findings of the study revealed that farmers widely used ICT tools, especially mobile phones/ smart phones on a daily basis by 66.67 per cent farmers of Jalandhar and 63.34 per cent by Tarn Taran, for agricultural purposes. Farmers mainly utilized ICT for obtaining information related to soil fertility management, weather information and recent agricultural practices. The results further suggest that although ICT have strong potential in agriculture, their effective utilization is influenced by factors such as accessibility, awareness and digital literacy. Strengthening digital literacy and promoting ICT content in local language (punjabi) can significantly enhance the adoption and efficient use of ICT tools among farmers.

Keywords : agricultural information, digital literacy, farmers, fertility management

INTRODUCTION

The application of Information and Communication Technologies (ICTs) in agriculture has emerged as a transformative approach for strengthening agricultural extension systems by facilitating timely, accurate and location-specific dissemination of information to farmers (Ganvit and Chandravadia, 2024). Globally, ICT-enabled interventions have demonstrated significant potential in enhancing farm productivity, improving market linkages and supported informed decision-making among farmers (Mallick et al., 2023). In the United States, about 56.00 per cent of farmers use farm management software, while 80.00 per cent of farmers in developed countries use digital tools for decision-making. Countries like China and Brazil are also rapidly advancing digital agriculture,

with 84.00 per cent of Brazilian farmers using at least one digital agriculture tool (Bhuva et al., 2021).

India's agricultural system has transformed since the Green Revolution through improved crop varieties, fertilizers, irrigation, and mechanization, helping achieve food grain self-sufficiency. However, challenges such as declining soil fertility, groundwater depletion, rising input costs and labour scarcity highlight the need for efficient resource management and timely information (Khodifad and Solanki, 2023). Punjab, being one of the most agriculturally advanced states in India, provides a unique setting for examining the utilization pattern of ICT tools (Chauhan et al., 2016; Pratik & Vinaya, 2022; Pratik et al., 2023). Despite better infrastructure and high literacy levels, the effective utilization of ICTs among farmers

remains uneven. Singh et al., (2025) suggests in their study to policy makers and extension agencies to come up with specific interventions to satisfy the needs and communication trends of farmers. Kumar (2025) in their study found that farmers, particularly young ones, rarely used ICT tools like smartphones to obtain agricultural knowledge for improvement, instead, they used them mostly for personal enjoyment and connectivity. By planning educational programs and training, farmers' support for increasing digital literacy for agricultural development and ICT adoption might be strengthened (Mishra *et al.*, 2025; Ganvit *et al.*, 2025; Shekhva *et al.*, 2025; Bhuva *et al.*, 2024; Rathod *et al.*, 2024). ICT in agriculture is necessary to boost agricultural productivity, expand knowledge resources, improve information access, boost agricultural process efficiency, and enhance human well-being. Comprehending the distribution, content analysis, adoption levels, and use of ICT tools for specific information needs among farmers. The purpose of this study is to investigate how farmers accept and use ICT tools for sustainable agricultural practices. This is because adopting and using ICT tools is essential to achieving sustainable agriculture (Zade et al., 2024).

OBJECTIVE

To analyze the utilization pattern of Information and Communication Technology by the farmers of Punjab

METHODOLOGY

The present study was conducted during the year

2024-2026 in two purposively selected districts of Punjab, namely, Jalandhar (having highest literacy rate) and Tarn Taran (having lowest literacy rate) to capture variations in ICT utilization among farmers (Census, 2011). The study followed the interpretivism research philosophy with inductive approach, focused on collecting actual data of ICT utilization. A qualitative methodological approach was adopted using ex-post facto research design.

In the first stage, two districts were selected purposively. In the second stage, two blocks were selected randomly from each districts. From Jalandhar district, Bhogpur and Jalandhar-West blocks were selected, while from Tarn Taran district, Tarn Taran and Gandiwind blocks were selected. In the final stage, 30 farmers were selected randomly from each block, making a total sample size of 120 farmers. The study was cross-sectional in nature, as data was collected at a single point in time. The dependent variable was the utilization pattern of ICT among farmers. Primary data were collected through personal interviews using a well-structured and pre-tested interview schedule to ensure reliability and validity of the instrument. The collected data were analyzed using appropriate statistical tools such as frequency, percentage, mean and standard deviation with the help of MS Excel software/SPSS.

Ethical considerations were maintained an informed consent was obtained from all respondents prior to data collection.

RESULTS AND DISCUSSION

Table 1: Distribution of farmers according to their utilization pattern of ICTs

(n=120)

Sr. No.	ICT tools	Extent of utilization									
		Jalandhar (n=60)					Tarn Taran (n=60)				
		Daily f (%)	Weekly f (%)	Once in a fortnight f (%)	Once a Month f (%)	Never f (%)	Daily f (%)	Weekly f (%)	Once in a fortnight f (%)	Once a Month f (%)	Never f (%)
1.	Radio	-	-	2 (3.33)	4 (6.67)	54 (90.00)	-	1 (1.67)	2 (3.33)	3 (5.00)	54 (90.00)
2.	Television	19 (31.67)	14 (23.33)	11 (18.33)	7 (11.67)	9 (15.00)	18 (30.00)	12 (20.00)	11 (18.33)	8 (13.34)	11 (18.33)
3.	Telephone	1 (1.67)	2 (3.33)	5 (8.33)	11 (18.33)	41 (68.34)	1 (1.67)	3 (5.00)	5 (8.33)	10 (16.67)	41 (68.33)
4.	Mobile Phones/ smart phones	40 (66.67)	13 (21.67)	3 (5.00)	2 (3.33)	2 (3.33)	38 (63.34)	12 (20.00)	2 (3.33)	3 (5.00)	5 (8.33)
5.	e-NAM portal	2 (3.33)	2 (3.33)	5 (8.33)	14 (23.34)	37 (61.67)	1 (1.67)	2 (3.33)	4 (6.67)	13 (21.67)	40 (66.66)
6.	PAU website	3 (5.00)	8 (13.33)	12 (20.00)	11 (18.33)	26 (43.34)	3 (5.00)	9 (15.00)	10 (16.67)	11 (18.33)	27 (45.00)

Sr. No.	ICT tools	Extent of utilization									
		Jalandhar (n=60)					Tarn Taran (n=60)				
		Daily f (%)	Weekly f (%)	Once in a fortnight f (%)	Once a Month f (%)	Never f (%)	Daily f (%)	Weekly f (%)	Once in a fortnight f (%)	Once a Month f (%)	Never f (%)
7.	mKisan SMS portal	1 (1.67)	2 (3.33)	4 (6.67)	13 (21.67)	40 (66.66)	1 (1.67)	3 (5.00)	3 (5.00)	14 (23.33)	39 (65.00)
8.	Krishi Vigyan Kendra (KVK) portal	3 (5.00)	5 (8.33)	9 (15.00)	9 (15.00)	34 (56.67)	4 (6.67)	3 (5.00)	7 (11.67)	9 (15.00)	37 (61.66)
9.	Krishi DSS portal	2 (3.33)	2 (3.33)	4 (6.67)	6 (10.00)	46 (76.67)	1 (1.67)	2 (3.33)	4 (6.67)	7 (11.67)	46 (76.66)
10.	Kiosk	1 (1.67)	3 (5.00)	3 (5.00)	8 (13.33)	45 (75.00)	1 (1.67)	2 (3.33)	3 (5.00)	6 (10.00)	48 (80.00)
11.	e- Newspapers	2 (3.33)	5 (8.33)	4 (6.67)	9 (15.00)	40 (66.67)	2 (3.33)	3 (5.00)	3 (5.00)	8 (13.33)	44 (73.34)
12.	e-agricultural Magazines	3 (5.00)	4 (6.67)	3 (5.00)	7 (11.67)	43 (71.66)	3 (5.00)	2 (3.33)	2 (3.33)	7 (11.67)	46 (76.67)

The data presented in the table-1 revealed that mobile phones/smartphones are the most frequently utilized ICT tool among farmers in both districts. In Jalandhar, majority of the farmers, 66.67 per cent reported daily used it, while in Tarn Taran it was 63.34 per cent, showing strong penetration of mobile-based communication. This reflects the increasing accessibility, affordability and multifunctionality of smartphones for agricultural information, aligning with the rapid digitalization of rural extension systems (Khatri et al. 2024). Traditional ICT tools such as television still maintain moderate usage, with around 30.00–32.00 per cent of farmers using it daily in both districts. However, radio has become largely obsolete, with about 90.00 per cent of farmers in both areas reporting “never” using it. This shift suggests a transition from one-way, traditional media to interactive and personalized ICT tools (Shehrawat et al. 2024). Low utilization levels were observed for institutional and web-based platforms such as e-NAM portal, mKisan SMS portal, PAU website, KVK portal and Krishi DSS portal, whereas the majority of farmers, i.e., 60.00 per cent reported “never” using these services. This indicates a significant gap between the availability of digital agricultural services and their actual adoption by farmers. Limited awareness, digital literacy constraints and perceived complexity may be contributing factors.

The findings are consistent with earlier findings by Chakraborty and Kumar (2025) that reported higher reliance on mobile phones and lower adoption of formal digital agricultural platforms. From an extension perspective, these results highlight the need to strengthen

capacity-building programs focusing on digital literacy and awareness of agricultural portals. Extension agencies should prioritize mobile-based advisory services, as they align with farmers’ current usage patterns. Additionally, integrating user-friendly interfaces and local language content in portals can enhance adoption. Strengthening last-mile connectivity through institutions like KVKs can also bridge the gap between technology availability and utilization. Overall, the study underscores that while ICT infrastructure exists, its effective utilization depends on usability, accessibility and extension support mechanisms.

Table-2: Distribution of farmers according to their overall utilization pattern of ICTs

(n=120)

S. No.	Category	Jalandhar	Tarn Taran
		f (%)	f (%)
1	Low (Below 4.923)	27 (45.00)	33 (55.00)
2	Medium (Between 4.923 ± 8.76)	21 (35.00)	18 (30.00)
3	High (Above 8.76)	12 (20.00)	9 (15.00)
Total		60 (100.00)	60 (100.00)

The data presented in the table-2 revealed the distribution of farmers across ICT utilization categories and found that a majority of farmers fall under the low utilization group, comprising 45.00 per cent in Jalandhar and 55.00 per cent in Tarn Taran, suggests that despite the availability of ICT tools, their effective

use remains limited among farmers, particularly in Tarn Taran, followed by 35.00 per cent of the farmers in Jalandhar and 30.00 per cent farmers in Tarn Taran belonged to the medium utilization category, reflecting moderate engagement with ICT tools, while only 20.00 per cent in Jalandhar and 15.00 per cent in Tarn Taran belonged to the high utilization category, indicating that intensive and efficient use of ICT is still restricted to a minority. These results are consistent with recent studies by Shehrawat et al., (2024) and reported that although awareness of ICT tools is increasing, actual adoption levels, especially of advanced technologies remains low due to lack of training, digital skills and perceived complexity. The predominance of low ICT utilization calls for focused extension interventions to enhance farmer's competency and confidence in using digital tools. There is a need to strengthen digital literacy and skill-oriented

training programmes, promote hands-on exposure and demonstrations of ICT tools, encourage farmer-friendly and localized digital platforms and enhance the role of extension agencies and KVKs in bridging the knowledge gap. By improving awareness, skills and accessibility, farmers can be shifted from low to higher utilization categories, thereby enhancing the effectiveness of ICT in agricultural development.

Relationship of independent variables with utilization pattern of ICTs of farmers

In order to study the nature of relationship between independent variables and utilization pattern of farmers, Pearson's correlation analysis was followed using standard statistical packages software (SPSS). The main reason for using correlation was that it helps to quantify how strongly two variables were associated.

Table-3: Relationship of independent variables with utilization pattern of ICTs of farmers (n=120)

Sr. No.	Independent variables	Jalandhar (n ₁ =60)		Tarn Taran (n ₂ =60)	
		Correlation coefficients ('r' Value)	'p' Value	Correlation coefficients ('r' Value)	'p' Value
1	Age	-0.318	0.013	-0.166	0.205
2	Education	0.817**	0.000	0.424**	0.001
3	Occupation	0.342	0.007	0.135	0.008
4	Family size	0.305	0.008	0.040	0.002
5	Land holding	0.104	0.104	0.096	0.003
6	Annual income	0.272*	0.003	0.090	0.004
7	Trainings attended	0.297	0.021	0.084	0.003
8	Source of information	0.272	0.035	0.212	0.001
9	Innovativeness	0.272	0.002	0.154	0.003

'p' value less than 0.01 implies that correlation is significant

The data presented in the table-3 shows the correlation results which revealed that education is the most significant factor influencing ICT utilization in both districts, showing a strong positive relationship. This implies that more educated farmers are better able to access and use ICT tools. Age shows a negative and significant relationship in Jalandhar, indicating that younger farmers are more inclined towards ICT use, while it is non-significant in Tarn Taran. Variables such as occupation, family size, training attended, source of information, and innovativeness show positive associations, especially in Jalandhar, suggesting that socially active, well-informed, and progressive farmers tend to utilize ICT tools more effectively. Annual income also positively influences ICT use in Jalandhar, whereas land holding shows limited or inconsistent influence across districts. Overall, the findings are similar to the findings of Shehrawat et al., 2024 and suggest that education, access to information and innovativeness are key drivers, while age may act as a constraint. Efforts should focus on improving digital literacy, training and information access, especially for

older and less educated farmers to enhance ICT utilization.

Purpose of utilization of ICTs

The data presented in the table-4 table shows that mobile phones/smartphones are the most widely used ICT tool for multiple purposes in both districts, particularly for accessing latest agricultural information, weather updates and market information. For instance, 75.00 per cent of farmers in Jalandhar and 71.67 per cent in Tarn Taran use mobile phones for latest agricultural information, indicating their central role in real-time decision-making. Television is the second most important source, mainly used for agricultural updates and soil fertility information, while telephones are relatively more used for market-related information. In contrast, traditional tools like radio show limited use across all purposes. Institutional ICT platforms such as e-NAM, PAU website, KVK and mKrishi portals exhibit moderate utilization, whereas advanced tools like Krishi DSS and kiosks have relatively lower usage, indicating limited awareness or accessibility.

Table-4: Distribution of farmers according to the purpose of utilizing ICTs (n=120)

Sr. No.	ICT Tools	Purpose of utilization									
		Jalandhar (n ₁ =60)					Tarn Taran (n ₂ =60)				
		Latest information regarding agriculture f (%)	Weather information f (%)	Market information f (%)	Information regarding pests and diseases f (%)	Information regarding soil fertility and nutrient management f (%)	Latest information regarding agriculture f (%)	Weather information f (%)	Market information f (%)	Information regarding pests and diseases f (%)	Information regarding soil fertility and nutrient management f (%)
1.	Radio	12 (20.00)	5 (8.33)	3 (5.00)	10 (16.67)	8 (13.33)	11 (18.33)	6 (10.00)	4 (6.67)	9 (15.00)	9 (15.00)
2.	Television	39 (65.00)	31 (51.67)	20 (33.33)	22 (36.67)	35 (58.33)	36 (60.00)	28 (46.67)	21 (35.00)	18 (30.00)	31 (51.67)
3.	Telephone	10 (16.67)	13 (21.67)	19 (31.67)	12 (20.00)	16 (26.67)	9 (15.00)	11 (18.33)	16 (26.67)	19 (31.67)	18 (30.00)
4.	Mobile phones/smart phones	45 (75.00)	40 (66.67)	38 (63.33)	30 (50.00)	25 (41.67)	43 (71.67)	37 (61.67)	40 (66.67)	27 (45.00)	22 (36.67)
5.	e-NAM portal	14 (23.33)	11 (18.33)	8 (13.33)	10 (16.67)	13 (21.67)	13 (21.67)	9 (15.00)	11 (18.33)	8 (13.33)	14 (23.33)
6.	PAU website	28 (46.67)	20 (33.33)	16 (26.67)	19 (31.67)	21 (35.00)	26 (43.33)	17 (28.33)	19 (31.67)	15 (25.00)	24 (40.00)
7.	mKrishi SMS portal	14 (23.33)	12 (20.00)	10 (16.67)	11 (18.33)	13 (21.67)	12 (20.00)	11 (18.33)	12 (20.00)	10 (16.67)	14 (23.33)
8.	Krishi Vigyan Kendra (KVK)	19 (31.67)	10 (16.67)	13 (21.67)	15 (25.00)	13 (21.67)	17 (28.33)	11 (18.33)	12 (20.00)	14 (23.33)	15 (25.00)
9.	Krishi DSS platform	10 (16.67)	11 (18.33)	8 (13.33)	11 (18.33)	12 (20.00)	11 (18.33)	9 (15.00)	7 (11.67)	13 (21.67)	10 (16.67)
10.	Kiosk	10 (16.67)	11 (18.33)	7 (11.67)	8 (13.33)	13 (21.67)	10 (16.67)	9 (15.00)	8 (13.33)	9 (15.00)	12 (20.00)
11.	e- Newspaper	12 (20.00)	10 (16.67)	11 (18.33)	13 (21.67)	15 (25.00)	11 (18.33)	10 (16.67)	12 (20.00)	11 (18.33)	17 (28.33)
12.	e- agricultural Magazines	11 (18.33)	9 (15.00)	8 (13.33)	11 (18.33)	12 (20.00)	12 (20.00)	7 (11.67)	8 (13.33)	10 (16.67)	13 (21.67)

*Multiple response

Overall, farmers primarily rely on easily accessible and user-friendly ICT tools (mobile phones and television) for diverse information needs, while formal digital platforms are underutilized. These findings are consistent with recent studies of Khatri et al. (2024) and indicating that farmers prefer mobile-based and simple ICT tools for timely and need-based agricultural information, whereas complex platforms witness lower adoption due to skill and awareness gaps. Extension efforts should focus on promoting mobile-based advisory services as primary communication channels, enhancing awareness and training on institutional platforms (e-NAM, KVK, DSS), developing user-friendly and localized digital content and strengthening multi-channel communication strategies combining traditional and modern ICT tools. This will help bridge the gap between ICT availability and its effective utilization.

CONCLUSION

The study revealed that farmers in both districts utilized various ICT tools primarily for accessing agricultural information such as weather updates, market information and pest management practices. Mobile phones/smartphones and television emerged as the most frequently used sources, while traditional tools and digital platforms were utilized less frequently. The findings further indicate regional differences, as farmers in Jalandhar district showed higher utilization of ICT tools compared to those in Tarn Taran district, influenced by better access and literacy levels. Overall, the study highlights that the utilization pattern of ICTs among farmers is influenced by accessibility, awareness and digital literacy, emphasizing the need to strength these factors to improve effective use of ICTs in agriculture.

RECOMMENDATIONS

- (1) **Strengthening Digital Literacy and Capacity Building:** It is recommended that extension agencies, KVKs and government departments should organize regular training programmes, workshops and village-level demonstrations to enhance digital literacy among farmers, especially small and marginal farmers. This will improve their effective utilization of ICT tools such as mobile applications and online advisory services.
- (2) **Development of Localized and Farmer-Centric ICT Content:** Policy makers and agri-tech firms should focus on providing timely, relevant and location-specific agricultural information in local languages (Punjabi). Customized content related to weather,

market prices and pest management can significantly enhance the adoption of ICTs among farmers.

- (3) **Strengthening Institutional Support and Collaboration:** There is a need for stronger collaboration between extension agencies, government departments and private ICT service providers to promote the use of ICTs. Policies should support the integration of digital advisory systems with existing agricultural extension services to ensure wider outreach and effectiveness.

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

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