E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; SP-8(12): 33-37
Received: 17-10-2025
Accepted: 19-11-2025

Sumesh Sharma
Research Scholar, Department of Social Sciences, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Pratima Rana
Assistant Professor, Directorate of Extension Education, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Nikhil Thakur
PG Student, Department of Social Sciences, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Kritika Bharti
PG Student, Department of Social Sciences, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Shaina Katoch
PG Student, Department of Social Sciences, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Corresponding Author:
Sumesh Sharma
Research Scholar, Department of Social Sciences, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

A systematic assessment of constraints influencing ICT adoption in agriculture sector

Sumesh Sharma, Pratima Rana, Nikhil Thakur, Kritika Bharti and Shaina Katoch

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i12Sa.4330

Abstract
Agriculture in India increasingly depends on Information and Communication Technologies (ICTs) for improving productivity, yet adoption in hilly regions remains limited. This study, conducted in Solan district of Himachal Pradesh with 120 respondents across 20 Gram Panchayats, examined barriers to ICT use through the Garrett Ranking Technique. The results revealed that the lack of government support ranked highest (87.44), followed by the time and practice required to learn ICT tools (62.52) and low digital literacy among farmers (62.17). Other major challenges included inconvenient timings of broadcasts (61.28), high initial costs (58.11), absence of localized content (57.25), and poor internet networks (57.08). Lesser but notable constraints were recurring expenditures (56.51), poor ICT infrastructure (55.07), and electricity problems (39.79). The findings highlight that although farmers are aware of ICT benefits, systemic constraints restrict effective utilization. Strengthening institutional support, investing in rural infrastructure, and creating localized, user-friendly digital platforms are critical. The study suggests that addressing these barriers can significantly enhance ICT adoption, enabling farmers in hilly regions to access timely information and improve livelihood security.

Keywords: Information and Communication Technology (ICT), agriculture, digital divide, barriers to adoption, and farmers

Introduction
Agriculture continues to be the backbone of rural livelihoods in India, employing nearly half of the workforce and contributing significantly to food security and the economy. However, the sector is increasingly confronted with challenges such as climate variability, resource scarcity, fragmented landholdings, market uncertainties, and low productivity. In this context, Information and Communication Technologies (ICTs) are recognized as a powerful enabler for agricultural transformation. ICTs facilitate timely access to agricultural knowledge, market information, weather updates, pest and disease control measures, and government schemes, thereby helping farmers make informed decisions and improve productivity (Meera *et al*., 2004; Mittal & Mehar, 2012) [11, 12].

The rapid expansion of digital tools such as mobile phones, internet-based services, social media platforms, mobile applications, and digital extension portals has created new opportunities for farmers to bridge information gaps. For instance, initiatives like m-Kisan Portal, Kisan Call Centres (KCCs), and AgriMobile Apps have been developed in India to provide customized information directly to farmers. Similarly, platforms such as YouTube and WhatsApp have become informal yet widely used channels for peer-to-peer knowledge sharing. The penetration of ICTs has also been bolstered by rising smartphone ownership, increased internet connectivity, and supportive government policies aimed at promoting digital agriculture (FAO, 2017; Gulati & Juneja, 2022) [7, 9].

Despite these opportunities, ICT adoption among farmers remains uneven and limited, particularly in rural and hilly regions such as Himachal Pradesh. Multiple studies have indicated that farmers face barriers such as low digital literacy, inadequate infrastructure, high costs of devices and data, language barriers, and limited localized content (Chhachhar *et al*., 2014; Sharma *et al*., 2019) [6, 16]. Furthermore, rural communities often encounter challenges related to

poor internet connectivity, electricity shortages, and limited institutional support, which hinder the effective utilization of ICTs for agricultural purposes (Saravanan, 2010; Adejo & Haruna, 2019) [14, 1].

Himachal Pradesh, though progressive in horticulture and vegetable production, is not immune to these challenges. The state's hilly terrain and dispersed settlements often limit infrastructure development, including internet networks and electricity supply. At the same time, the farming community in Himachal Pradesh is gradually adopting ICTs, especially mobile-based platforms, for seeking information on crop cultivation, weather advisories, pest management, and market prices. Yet, the barriers hindering ICT adoption remain underexplored at a localized level, particularly in districts like Solan, where agriculture and horticulture form the livelihood base of the majority.

The importance of studying barriers to ICT adoption lies in ensuring inclusive digital agricultural development. If farmers are unable to access or effectively use ICTs, the digital divide between urban and rural areas is likely to deepen, further marginalizing small and marginal farmers. Moreover, inadequate use of ICTs may reduce the effectiveness of government programs aimed at doubling farmers' income and promoting smart agriculture. Research on barriers also contributes to designing more farmer-centric ICT tools, building capacity for digital literacy, and strengthening extension services (Chhachhar & Hassan, 2013; Ali, 2019) [6, 3].

Several studies across the globe have emphasized the constraints in ICT adoption. For instance, Aker (2011) [2] highlighted that while mobile phones significantly reduce information asymmetry in African agriculture, issues of affordability and literacy limit widespread benefits. Similarly, studies in South Asia and Sub-Saharan Africa have consistently found that infrastructure, cost, and digital skills are critical determinants of ICT adoption (Mittal & Tripathi, 2009; Gillwald *et al*., 2010; Asongu & Boateng, 2018) [13, 8, 4]. In the Indian context, inadequate government support, language diversity, and poor ICT awareness have been flagged as major concerns (Kumar *et al*., 2015; Sharma & Chauhan, 2021) [10, 15].

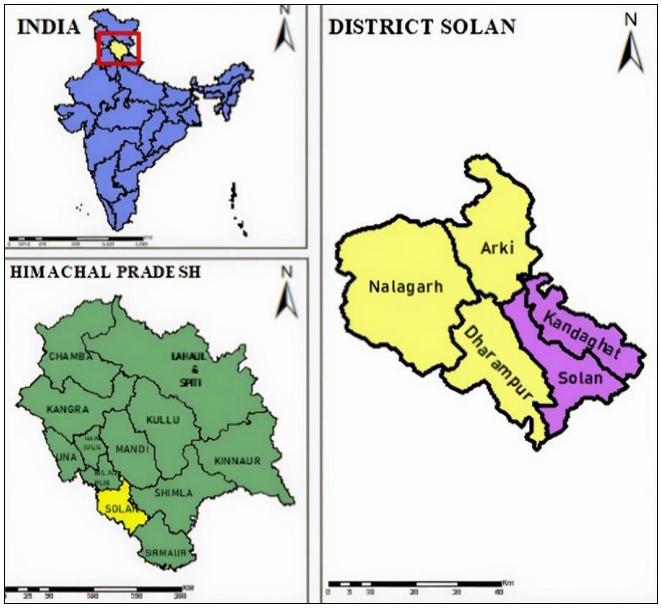
In light of these gaps, the present study was undertaken in Solan district of Himachal Pradesh with the objective of identifying and ranking the barriers faced by farmers in using ICTs. By employing the Garrett Ranking Technique, the study provides insights into the relative importance of different constraints and offers recommendations for policymakers, extension agencies, and ICT developers to design more effective strategies for digital agricultural transformation. The findings are expected to contribute to bridging the digital divide and enhancing the inclusivity of ICT-enabled agricultural development.

Objective

To assess the constraints in the utilization of ICTs among farmers in Solan district.

Methodology

The present study was conducted in Solan district of Himachal Pradesh, which is administratively divided into five blocks i.e., Dharmpur, Solan, Kandaghat, Kunihar, Nalagarh. Out of these, two blocks—Solan and Kandaghat—were selected using a simple random sampling technique. A multistage random sampling method was adopted, wherein one-third of Gram Panchayats from each block were selected, resulting in 20 Gram Panchayats. From each Panchayat, six farmers who owned at least one ICT tool or had an active social media account were purposively chosen, yielding a sample of 120 respondents. Data were collected using a pre-tested, structured interview schedule. Barriers to ICT adoption were identified and analyzed using the Garrett Ranking Technique, which facilitated prioritization of constraints based on farmers' perceptions.



Results and Discussion

The analysis of barriers faced by farmers in adopting ICTs revealed a complex interplay of infrastructural, socio-economic, and institutional constraints. Using the Garrett Ranking Technique, fourteen key barriers were ranked based on farmer perceptions in Solan district of Himachal Pradesh. The results highlight that while ICT tools hold transformative potential, systemic and localized constraints limit their full adoption and utilization.

Table 1: Distribution of respondents according to the barriers faced for using ICT

Rank	Barrier	Garret Score
I	Lack of support by the government	87.44
II	More time and practice required to learn the tools to use	62.52
III	Low digital literacy rate among farmers	62.17
IV	The time of broadcasting and conferencing is not convenient	61.28
V	The initial cost is more	58.11
VI	Lack of local content in the local language	57.25
VII	Problem in Internet network	57.08
VIII	Complexity in using ICT	56.59
IX	Recurring expenditure is more	56.51
X	Poor ICT infrastructure	55.07
XI	Lack of ICT literacy among farmers	54.66
XII	Unable to access information using ICT	53.02
XIII	Less availability of time for using ICT tools	43.7
XIV	Electricity Problem	39.79

1. Lack of Government Support (Rank I, Score 87.44)

The most critical barrier identified was the lack of government support, with an overwhelming Garrett score of 87.44. Farmers expressed that ICT-based initiatives often remain under-promoted, poorly monitored, and inadequately funded. Many were unaware of government schemes such as the m-Kisan Portal or Kisan Call Centres (KCCs), indicating weak dissemination strategies by extension agencies.

This finding aligns with Saravanan (2010) [14], who noted that inadequate institutional backing hampers the sustainability of

ICT projects in rural areas. Similarly, Ali (2019) [3] emphasized that government negligence in providing training and awareness reduces farmers' motivation to adopt digital tools. Hence, strengthening extension systems and proactive government engagement remain crucial.

2. Time and Practice Required to Learn ICT Tools (Rank II, Score 62.52)

Farmers ranked the need for more time and practice as the second barrier. ICT tools, though beneficial, were perceived as time-consuming and technically challenging, particularly for older farmers. Digital skills were not acquired intuitively, and the absence of localized training programs exacerbated the issue. This resonates with Mittal and Mehar (2012) [12], who found that farmers often struggle with unfamiliar interfaces and require repetitive guidance. Chhachhar *et al*. (2014) [6] similarly reported that inadequate technical training reduces confidence and leads to under-utilization of ICTs. Thus, digital literacy training should be integrated into extension services.

3. Low Digital Literacy Rate (Rank III, Score 62.17)

Closely following was low digital literacy, particularly among small and marginal farmers. Despite widespread smartphone penetration, many respondents lacked the skills to use advanced ICT applications beyond basic calling and messaging. They often relied on children or younger family members for assistance.

A similar pattern has been observed in multiple contexts. Aker (2011) [2] and Gillwald *et al*. (2010) [8] highlighted that while mobile penetration is growing in rural Africa and Asia, digital literacy remains a bottleneck in ensuring meaningful ICT use. In Himachal Pradesh, this challenge is further compounded by linguistic barriers and low exposure to digital content in local dialects.

4. Inconvenient Timing of Broadcasting and Conferencing (Rank IV, Score 61.28)

Respondents highlighted that scheduled ICT-based programs such as agricultural telecasts or live expert conferencing often coincided with peak farming hours. This mismatch in timing discouraged participation, reflecting the need for farmer-centric scheduling.

Sharma & Chauhan (2021) [15] observed a similar mismatch in agricultural extension programs in northern India, where farmers missed important telecasts due to farm work. This indicates that flexibility, such as providing recordings or on-demand access, could significantly improve adoption.

5. High Initial Cost of ICT (Rank V, Score 58.11)

The cost of acquiring ICT tools—smartphones, laptops, or internet subscriptions—was ranked as a major constraint. For smallholders, investments in ICTs often competed with pressing household and farm expenditures.

This finding corroborates with Mittal & Tripathi (2009) [13], who argued that affordability is a decisive factor in ICT adoption. Asongu & Boateng (2018) [4] also stressed that cost barriers disproportionately affect marginalized farmers, widening the digital divide.

6. Lack of Local Content in Local Language (Rank VI, Score 57.25)

Farmers expressed difficulty in understanding ICT content, as most applications and portals are designed in English or Hindi, with little adaptation to local dialects of Himachal Pradesh. This language mismatch reduced farmers' interest in ICT-based learning.

Chhachhar & Hassan (2013) [5] and Adejo & Haruna (2019) [1] identified language barriers as a significant reason for limited ICT uptake in rural Asia and Africa. The provision of vernacular content can thus enhance comprehension and relatability.

7. Poor Internet Network (Rank VII, Score 57.08)

Connectivity issues were widely reported, especially in hilly terrains where network coverage is patchy and unreliable. Poor bandwidth limited access to video tutorials, online conferences, and real-time market data.

This finding mirrors Gulati & Juneja (2022) [9], who argued that internet infrastructure remains the Achilles heel of digital agriculture in India. Without robust connectivity, ICT initiatives fail to reach their full potential.

8-10. Complexity, Recurring Costs, and Poor ICT Infrastructure

The next three ranked barriers—complexity of ICT use (56.59), recurring expenditure (56.51), and poor ICT infrastructure (55.07)—all reflect the usability and sustainability challenge. Farmers indicated that ICT platforms were often designed without considering local user-friendliness. Moreover, recurring expenses for mobile data or app subscriptions were seen as burdensome.

Meera *et al*. (2004) [11] previously noted that ICT systems designed without farmer participation often fail. Infrastructure gaps such as limited access to ICT kiosks, weak mobile towers, and absence of rural training centers were also highlighted in earlier studies by Kumar *et al*. (2015) [10].

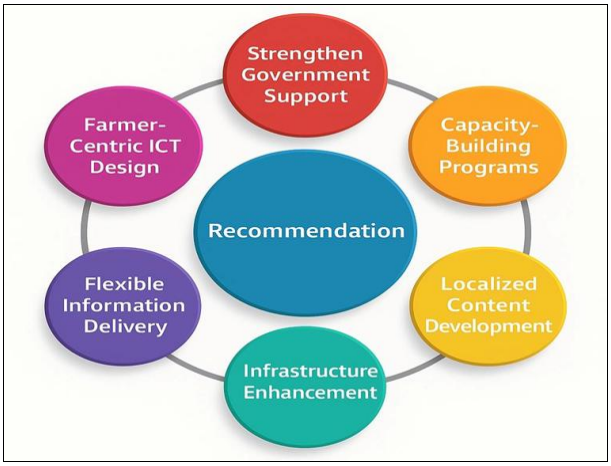
11-14. Literacy, Accessibility, Time, and Electricity Constraints

The lower-ranked barriers included lack of ICT literacy (54.66), inability to access relevant information (53.02), less availability of time (43.70), and electricity issues (39.79). While relatively less severe compared to earlier constraints, these still present practical hindrances. In remote villages, electricity shortages limited ICT usage, while farmers' busy schedules restricted time available for learning.

Similar issues were documented by Adejo & Haruna (2019) [1] in Nigeria and FAO (2017) [7] globally, where infrastructural and temporal limitations often reduced ICT utility.

Recommendations

Based on the findings, the following strategies are recommended to overcome ICT adoption barriers among farmers:



1. **Strengthen Government Support**

The government should enhance the promotion, awareness, and monitoring of ICT-based agricultural schemes. Active involvement of extension agents, local leaders, and farmer organizations will ensure effective dissemination. Regular reviews and participatory approaches will help bridge the trust gap between farmers and institutions. Incentives for ICT adoption can further motivate farmers to integrate these tools in farming practices.

2. Capacity-Building Programs

Farmers need structured training to effectively use ICT tools for agriculture. Digital literacy programs should be integrated into agricultural extension curricula at the village level. Hands-on workshops at Panchayat centers will enable farmers to practice and overcome hesitation. These initiatives should be continuous and inclusive, catering to small, marginal, and women farmers.

3. Localized Content Development

To increase usability, ICT tools and platforms must be developed in vernacular languages. Voice-assisted applications can support semi-literate and older farmers in accessing agricultural information. Locally relevant content—such as crop advisories, weather updates, and market prices—should be prioritized. Regular feedback from farmers will ensure the content remains practical and relevant.

4. Infrastructure Enhancement

Investment in rural ICT infrastructure is essential to reduce barriers to adoption. Strengthening internet connectivity and improving electricity supply in hilly and remote areas is critical. ICT kiosks and community resource centers should be set up at Panchayat offices. Public-private partnerships can be leveraged to accelerate infrastructure growth.

5. Affordable ICT Access

The high initial cost of ICT tools is a major barrier for small and marginal farmers. Providing subsidies on smartphones, affordable data packs, and free access to agricultural apps can reduce this constraint. Government and NGOs should collaborate to distribute affordable devices. Easy installment schemes for ICT gadgets can also encourage greater adoption.

6. Flexible Information Delivery

Agricultural information must be provided in a manner that aligns with farmers' daily routines. Broadcasting programs at farmer-convenient timings will ensure greater reach. Recorded sessions should be made available on demand via ICT platforms. Flexibility in delivery modes will maximize participation and utilization of information.

7. Farmer-Centric ICT Design

ICT tools should be designed with direct farmer input to ensure simplicity and relevance. Interfaces must be user-friendly, with step-by-step guidance for beginners. Farmers' preferences, challenges, and feedback should guide the development of ICT applications. Co-creation with farmers will increase ownership, usability, and long-term adoption.

By addressing these barriers through policy, infrastructure, and capacity development, ICT adoption can be accelerated, contributing to a more inclusive and sustainable agricultural development pathway.

Acknowledgement

The authors express their sincere gratitude to Dr. Samriti, Dr. Rajneesh and Dr. Dhirender of Dr. YSPUHF Nauni for their valuable time and insights. We also thank Shubhangini Jasta, Gauri Sharma, Om Prakash, Venus Thakur Alisha Thakur, Rakesh Kumar, Sabhyata, for their support in this study. Special thanks to the Department of Social Sciences, Dr. YSPUHF Nauni, for providing the necessary resources and guidance throughout the research. We appreciate the constructive feedback from peers and reviewers that enriched this work. Lastly, heartfelt thanks to AdiShakti Kamaksha, Sh. Prem Dutt Shastri Ji, Pawan Sharma, Meena Sharma and our families for their constant encouragement and support.

Authors contributions

Sharma Sumesh: Introduction, Analysis, - Original draft preparation, Rana Pratima: Methodology: Nikhil, Shaina & Kritika -Conclusion

Funding

Not applicable in the manuscript.

Conflict of Interests

The authors declare no conflict of interest.

References

1. Adejo PE, Haruna U. ICTs in agricultural development: Challenges and prospects for developing countries. Int J Agric Ext. 2019;7(1):41-47.
2. Aker JC. Dial "A" for agriculture: A review of information and communication technologies for agricultural extension in developing countries. Agric Econ. 2011;42(6):631-647.
3. Ali J. Adoption of information and communication technology (ICT) in agriculture and its impact. Indian J Agric Econ. 2019;74(3):395-410.
4. Asongu S, Boateng A. Mobile phones and inclusive human development in Sub-Saharan Africa. J Afr Bus. 2018;19(2):1-24.
5. Chhachhar AR, Hassan MS. The use of mobile phone among farmers for agriculture development. Int J Sci Res. 2013;2(6):95-98.
6. Chhachhar AR, Qureshi B, Khushk GM, Ahmed S. Impact of information and communication technologies in agriculture development. J Basic Appl Sci Res. 2014;4(1):281-288.
7. Food and Agriculture Organization (FAO). Information and Communication Technology (ICT) in Agriculture: Report of the FAO Committee on Agriculture. Rome: FAO; 2017.
8. Gillwald A, Milek A, Stork C. Gender assessment of ICT access and usage in Africa. Research ICT Africa Policy Paper. 2010;5:1-34.
9. Gulati A, Juneja R. Digital agriculture: India's tryst with technology. Indian J Agric Econ. 2022;77(3):457-471.
10. Kumar R, Singh RK, Pandey DK. Farmers' perception regarding usefulness of ICT in agriculture. Indian Res J Ext Educ. 2015;15(1):21-25.
11. Meera SN, Jhamtani A, Rao DUM. Information and Communication Technology in Agricultural Development: A Comparative Analysis of Three Projects from India. Agricultural Research and Extension Network Paper No. 135. London: ODI; 2004.
12. Mittal S, Mehar M. How mobile phones contribute to growth of small farmers? Evidence from India. Q J Int Agric. 2012;51(3):227-244.
13. Mittal S, Tripathi G. Role of mobile phone technology in

improving small farm productivity. Agric Econ Res Rev. 2009;22(1):451-459.
14. Saravanan R. ICTs for Agricultural Extension: Global Experiments, Innovations and Experiences. New Delhi: New India Publishing Agency; 2010.
15. Sharma S, Chauhan J. Barriers in adoption of ICT tools among farmers in Himachal Pradesh. Himachal J Agric Res. 2021;47(2):145-153.
16. Sharma V, Sharma P, Thakur R. Constraints in use of ICTs for agricultural extension services in Himachal Pradesh. Indian J Ext Educ. 2019;55(3):85-89.