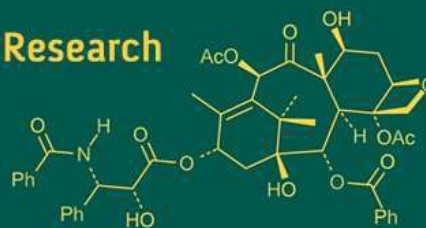


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Constraints affecting the adoption of digital tools among groundnut farmers in Banaskantha district of Gujarat: An analysis using Garrett ranking technique

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Abstract

Digital technologies offer significant potential to enhance agricultural productivity, profitability, and resilience by providing farmers with timely information and decision-support tools. However, adoption among smallholder farmers remains constrained by multiple socio-economic and infrastructural barriers. This study examined the constraints affecting the use of digital tools among groundnut farmers in Banaskantha district, Gujarat. Using an ex-post facto research design, structured interviews were conducted with 150 randomly selected farmers across 15 purposively selected villages in three key talukas. Constraints were ranked using Garrett's Ranking Technique. Limited access to reliable internet connectivity emerged as the most critical constraint (Garrett Mean Score: 59.94), followed by lack of digital literacy (49.14) and high costs of digital tools (42.00). Additional barriers included power supply instability, inadequate training opportunities, absence of localized content, language barriers, low trust in digital platforms, insufficient infrastructure, and limited awareness of digital benefits. Addressing these constraints through investments in rural digital infrastructure, targeted capacity-building programs, affordable technologies, and context-specific digital solutions is essential for bridging the digital divide. Strategic and collaborative interventions can enable effective adoption of digital tools, thereby enhancing productivity, market access, and livelihoods among groundnut farmers.

Keywords: Digital technologies, agriculture, smallholder farmers, groundnut, constraints, digital adoption, internet access

Introduction

India's agriculture, a cornerstone of its socio-economic development, faces persistent structural challenges such as land fragmentation, dwindling resources, climate variability, and limited adoption of modern practices. Recent advances in Information and Communication Technology (ICT) present significant opportunities to overcome these hurdles by enhancing the dissemination of timely, accurate, and relevant information to farmers (Chandra & Singh, 2021; Kumar *et al.*, 2023) ^[2, 5]. However, disparities in access, digital literacy, affordability, and the ability to effectively use ICT tools collectively termed the digital divide continue to impede equitable knowledge dissemination, particularly among smallholders and marginalized communities (Gunkel, 2003; Van Dijk, 2005) ^[8].

The digital divide is not merely about access; it also encompasses differences in capability, frequency of use, and the quality of digital engagement. These disparities are often exacerbated by factors such as socio-economic status, education, age, gender, and geographical location (Chandra *et al.*, 2021) ^[2]. Consequently, many farmers remain excluded from critical information on market prices, weather forecasts, pest and disease management, and innovative farming practices, limiting their ability to make informed decisions and adopt sustainable strategies.

Emerging digital technologies including mobile applications, precision agriculture tools, and real-time advisory services have demonstrated potential to revolutionize agricultural productivity and resilience (FAO, 1993; Ghogare, 2015) ^[3]. Yet, the uneven adoption of these innovations highlights the need for targeted interventions to bridge existing digital gaps. Addressing the constraints affecting the use of digital tools is essential for empowering farmers, enhancing their knowledge, and improving their adaptive capacity in the face of market and climate uncertainties. This study aims to identify the key constraints hindering ICT utilization among groundnut farmers and analyze how the digital divide affects

knowledge empowerment, providing insights to inform inclusive agricultural policies and extension strategies.

Methodology

An ex-post facto research design, as defined by Kerlinger (2004) [4], was employed in this study, recognizing that the patterns of adoption and constraints related to digital tools among groundnut farmers had already manifested and could not be experimentally manipulated. This design enabled systematic empirical inquiry into the factors contributing to the digital divide by observing variations in independent and dependent variables without researcher intervention. Gujarat state was purposively selected as the study area owing to its high telecommunication density (92.53%) and leading position in groundnut production (TRAI, 2023). Banaskantha district, the largest producer of groundnut in the state, was chosen as the locale for this investigation. Three talukas within Banaskantha, Dantiwada, Deesa, and Palanpur were purposively selected based on the largest groundnut cultivation areas. Five villages with the highest groundnut area were identified within each taluka, resulting in a total of 15 villages included in the study.

A multistage sampling approach was used to ensure representativeness. From each selected village, 10 groundnut growers were randomly selected from official records, yielding a total sample size of 150 respondents. Primary data were collected through structured, pre-tested interviews using a validated questionnaire that captured socio-economic, infrastructural, and psychological constraints affecting the use of digital tools and ICT. Respondents were asked to rank a predefined set of constraints identified from relevant literature (Aker, 2011; Mittal & Mehar, 2016; Kumar *et al.*, 2023) [1, 6, 5]. Garrett's Ranking Technique (Garrett & Woodworth,) was utilized to convert these ranks into quantitative scores, allowing systematic prioritization of constraints. The percent position of each rank was calculated using the formula:

$$\text{Percent position} = \frac{100(R_{ij} - 0.5)}{N_j}$$

Where,

R_{ij} = Rank given for the i^{th} constraints by the j^{th} respondent

N_j = Number of constraints ranked by the j^{th} respondent

The calculated percent positions were then converted into scores using Garrett's conversion table. The mean score for each constraint was computed across respondents and arranged in descending order to determine their relative severity. This method transformed subjective perceptions into objective measures, facilitating clear identification of the most significant constraints hindering effective ICT utilization among groundnut farmers and providing a foundation for targeted extension interventions.

Results and Discussion

The analysis of constraints affecting the adoption of digital technologies among groundnut farmers, as presented in Table 1, revealed a clear hierarchy of barriers through Garrett Ranking analysis. The most critical constraint identified was limited access to reliable internet connectivity, which received the highest Garrett Mean Score (GMS) of 59.94. This finding underscores the persistent digital infrastructure gap in rural areas, where poor or absent internet coverage significantly limits farmers' ability to

access essential digital resources, including real-time market prices, pest and disease alerts, weather forecasts, and digital extension services. This aligns with observations by Kumar *et al.* (2023) [5] that inadequate rural internet infrastructure remains a primary impediment to effective ICT integration in Indian agriculture.

The second highest-ranked constraint was lack of technical knowledge and digital literacy, with a GMS of 49.14. This result highlights the limited capacity among farmers to navigate digital tools and platforms due to low educational attainment and minimal exposure to technology. Even when connectivity is available, the absence of digital skills prevents meaningful utilization of digital services. High costs associated with acquiring and maintaining digital devices ranked third (GMS: 42.00), reflecting the economic challenges faced by smallholder farmers who struggle to afford smartphones, computers, and ongoing data expenses. Power supply instability, with a GMS of 39.79, emerged as the fourth major constraint, indicating that frequent power outages in rural areas disrupt the consistent use of digital devices, thus hindering timely access to agricultural information.

Inadequate training and support were ranked fifth (GMS: 38.76), suggesting that many farmers lack opportunities to build confidence and competence in using digital tools. This is consistent with findings by Mittal and Mehar (2016) [6], who emphasized the importance of structured training programs to improve ICT adoption among farmers. The limited availability of localized digital solutions was identified as the sixth constraint (GMS: 24.27), indicating that existing platforms often fail to account for region-specific agronomic practices, pests, and climatic conditions, thereby reducing their relevance and appeal. Language barriers and lack of user-friendly interfaces, ranked seventh (GMS: 19.44), further hinder adoption, particularly among farmers who speak local dialects or possess limited reading ability, as many digital tools remain available only in English or major regional languages.

Low trust in digital platforms (GMS: 16.24) was the eighth-ranked constraint, reflecting farmers' skepticism about the reliability and safety of digital information, often stemming from previous experiences with misinformation or scams. Inadequate infrastructure to support integration of digital technologies, with a GMS of 7.56, was ranked ninth, pointing to the absence of physical facilities such as community digital centers or local technical support that could facilitate digital engagement. Finally, limited awareness of the benefits of digital tools was the least prioritized constraint (GMS: 6.57), suggesting that a segment of farmers remains unaware of how digital technologies could improve productivity, profitability, and market access. These findings are in partial agreement with Mukherjee *et al.* (2023) [7], who reported similar patterns of constraints affecting digital technology adoption in Indian agriculture.

The Garrett ranking analysis highlights that the foremost barriers to digital technology adoption among groundnut farmers are related to internet connectivity, digital literacy, and affordability of digital tools. These primary constraints are exacerbated by unstable electricity, lack of localized content, limited training, and language-related challenges. Addressing these issues requires concerted efforts from government agencies, NGOs, private sector actors, and agricultural extension services to improve rural digital

infrastructure, design inclusive and context-specific digital platforms, and deliver sustained training and support programs. By systematically mitigating these constraints,

the integration of digital tools into groundnut farming can be accelerated, enhancing agricultural efficiency, income diversification, and overall rural development.

Table 1: Constraints faced by the groundnut growers in using ICT tools for production

Sr. No.	Constraints	GMS	Rank
1.	Limited access to reliable internet connectivity	59.94	I
2.	High costs of acquiring and maintaining digital tools	42.00	III
3.	Lack of technical knowledge and digital literacy	49.14	II
4.	Inadequate training and support	38.76	V
5.	Limited availability of localized digital solutions	24.27	VI
6.	Power supply instability in rural areas	39.79	IV
7.	Low trust in digital platforms	16.24	VIII
8.	Language barriers and lack of user-friendly interfaces	19.44	VII
9.	Limited awareness of the potential benefits	6.57	X
10.	Inadequate infrastructure to support the integration of digital technologies	7.56	IX

Conclusion

The study demonstrated that groundnut farmers in Banaskantha district encounter significant obstacles to adopting digital technologies, primarily due to unreliable internet connectivity, limited digital literacy, and high costs of digital devices. These issues are further exacerbated by unstable power supply, insufficient localized content, language barriers, and a lack of trust in digital platforms. Overcoming these constraints necessitates strategic investments in rural digital infrastructure, comprehensive digital literacy initiatives, enhanced affordability of devices and services, and the development of user-friendly, regionally tailored digital solutions. Strengthening agricultural extension systems and fostering coordinated action among government bodies, NGOs, private sector stakeholders, and research institutions will be critical to bridging the digital divide and enabling the transformative potential of digital agriculture to enhance productivity, livelihoods, and rural socio-economic development.

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