



Bridging the Digital Divide: Constraints to Digital Literacy Among Joint Liability Groups Women Farmers in Kerala

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HIGHLIGHTS

- Limited training opportunities emerged as the most critical barrier to digital literacy.
- Economic factors, particularly internet costs, significantly constrained access.
- Lack of mentorship and limited institutional initiatives weakened adoption.
- Educational and economic barriers emerged as the most severe dimensions.
- Holistic interventions are required to address interconnected barriers.

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ABSTRACT

Digital literacy remains a critical determinant of women farmers' ability to participate in and benefit from emerging agricultural innovations. Among women farmers in Joint Liability Groups (JLGs) in Kerala, multiple barriers continue to limit their effective digital engagement. To capture these constraints, data were collected from 280 respondents across 14 districts during April-May 2025 using a structured interview schedule supplemented by focus group discussions. Constraints were prioritised through Garrett's ranking technique. The findings revealed that limited training opportunities emerged as the most severe barrier (mean score 64.66), followed by high internet costs (56.28), lack of local mentorship (56.03), and insufficient government initiatives for digital adoption (55.35). Other important challenges included non-customised training programs (55.27), low digital proficiency (55.12), complex digital interfaces (54.82), dependence on family members (51.78), low motivation (50.59), and language barriers in training materials (48.40). The findings indicate that digital exclusion among JLG women farmers arises from interlinked educational, economic, infrastructural, and socio-cultural constraints. The study emphasises the need for gender-sensitive and context-specific training, affordable internet access, community-based mentorship, and targeted policy support to strengthen digital literacy and empower women farmers in Kerala's agrarian economy.

INTRODUCTION

Digital technologies are increasingly recognised as transformative tools in agriculture, driving improvements in productivity, efficiency, and sustainability (Pretty, 2018; Liakos et al., 2018). Precision farming (Gebbers & Adamchuk, 2010), AI-driven decision-support systems, blockchain-enabled supply chains

(Kamilaris et al., 2019), and IoT-based monitoring solutions exemplify innovations that reshape global farming practices. Yet, the benefits of this digital revolution remain unevenly distributed, particularly in developing economies where digital divides persist (Fuglie, 2018; World Bank, 2022). In India, where agriculture sustains nearly 55 per cent of the workforce and contributes about 18 per cent to national GDP (MoA&FW, 2023), bridging this divide

is vital to achieve the projected 70 per cent increase in food production required to meet future demand (FAO, 2023). Persistent disparities in access, affordability, and capacity continue to exclude smallholders and women farmers from fully benefiting from digital agriculture initiatives.

The gender dimension of this divide is particularly pronounced in India's agrarian economy. Women constitute nearly one-third of the agricultural workforce and almost half of self-employed farmers (NSSO, 2019), but face structural disadvantages such as limited land ownership (Agricultural Census, 2016), wage gaps of 20–30 per cent compared to men (ILO, 2022), and the “triple burden” of household, farm, and community responsibilities (Rao, 2012). The digital gap compounds these inequalities: only 8.5 per cent of rural women possess basic digital literacy compared with 17.1 per cent of rural men (MoSPI, 2019). Barriers include low smartphone ownership (GSMA, 2022), sociocultural restrictions (Gurumurthy et al., 2016), and the absence of gender-responsive agricultural content (Priya et al., 2021). Extension research demonstrates that targeted, gender-sensitive interventions reduce these gaps. Sharma & Singh (2022) show that digital inclusion initiatives improve women's access to agricultural information, while Singh et al. (2023) report that ICT-enabled extension services reduce structural and knowledge barriers when inclusively designed. Pal et al., (2015) reported that difficult terrain and poor connectivity in hilly areas, an unorganized farming community, lack of interest in farming due to uneconomic holding, and poor financial condition of the farmers were the prime constraints encountered by the agriculture extension officers.

Kerala provides a compelling case for examining these dynamics. Despite its high literacy rate (94%; Census, 2011), advanced digital infrastructure such as the Kerala Fibre Optic Network (KFON), and the Kudumbashree movement that mobilises over three million women (Kudumbashree Mission, 2023), significant disparities persist among women farmers in Joint Liability Groups (JLGs). This study, therefore, identifies and prioritises the constraints to digital literacy among JLG women farmers in Kerala, with the broader aim of outlining pathways to bridge the gendered digital divide and strengthen women's capacity to leverage opportunities in digital agriculture.

METHODOLOGY

The study was carried out across all 14 districts of Kerala to ensure comprehensive representation. Kerala hosts 96,177 Joint Liability Groups (JLGs) under Kudumbashree, involving 439,255 women farmers cultivating 21,457 hectares. Among these, Thrissur, Wayanad, and Kannur account for the largest share of JLGs, while Kollam and Palakkad represent smaller proportions. This extensive presence underscores their institutional significance and justified their selection as the unit of study. From each district, five JLGs were randomly chosen, and four members from each were selected, yielding 20 respondents per district and 280 in total. This two-stage sampling design ensured representation of multiple groups within each district, capturing both intra-group and inter-district variation. Such an approach prevented over-reliance on single groups and provided more reliable insights into the digital literacy scenario of JLG women farmers. JLGs were considered particularly

appropriate as they receive strong institutional backing, greater opportunities for capacity building, and play a vital role in women's empowerment and livelihood security, making them an ideal setting to examine digital literacy constraints in farming contexts.

Primary data were collected through a pre-structured interview schedule designed to capture constraints across diverse dimensions, including access and infrastructure-related barriers, individual challenges, socio-cultural restrictions, capacity-building limitations, policy and institutional issues, technological difficulties, and psychological factors. To supplement and validate these findings, focus group discussions (FGDs) were conducted in each district, offering qualitative insights and triangulation of results. These sessions provided greater depth in understanding socio-cultural dynamics, affordability concerns, infrastructural gaps, and institutional shortcomings.

The list of constraints was finalised through expert consultation and a review of relevant literature. Garrett's ranking technique was then used to prioritise the identified factors. Garrett's method (Garrett & Woodworth, 1969) ensures uniformity in score distribution and facilitates clear prioritisation, even when the number of items or ranking patterns varies. Using the Garrett table, the calculated per cent positions were converted into scores. The individual scores for each factor were aggregated and divided by the total number of respondents to determine the mean scores.

RESULTS

The data in Table 1 reveal that the most critical constraint was limited training opportunities (Mean score: 64.66), highlighting the inadequacy of structured and localised training for women farmers. This result is in line with earlier findings by Mittal et al., (2017) & Kumar et al., (2025), who emphasised that training gaps are a major impediment to digital literacy among rural populations.

The high cost of internet services and recharges (56.28) was the second most pressing constraint. Affordability issues continue to limit consistent internet use, as also observed by Mukherjee et al., (2023) in their assessment of barriers to digital adoption in Indian agriculture. The lack of local mentorship (56.03), ranked third, indicates the absence of peer or community guidance in digital adoption, similar to the observations of Sen (2015), who noted that localised support networks are vital in encouraging rural women's engagement with technology. Institutional and policy-related issues were also prominent. Limited government initiatives for promoting digital adoption in agriculture (55.35) and non-customised programs (55.27) were ranked fourth and fifth, respectively. These results are in line with Heeks (2018), who argued that top-down digital interventions often fail to align with grassroots realities. Low digital proficiency (55.12) and complex digital interfaces (54.82) further constrained adoption, which is consistent with the findings of Schnebelin (2022), who emphasised that user-unfriendly applications discourage participation among farmers with low literacy levels. Psychological and social barriers were ranked in the middle order. Dependence on family members (51.78) and low motivation levels (50.59) reflect attitudinal and autonomy-related challenges, as reported by Chakraborty & Gupta (2019). Language barriers in training materials (48.40) also affected digital literacy efforts, confirming the importance of localised content highlighted

Table 1. Constraints faced by JLG women farmers in improving digital literacy

S. No.	Statements	Mean Score	Rank
<i>Access and Infrastructure-Related Constraints</i>			
1.	Limited Internet Penetration	33.77	15
2.	Unstable Network Infrastructure	41.75	12
3.	High costs associated with internet services and recharges	56.28	2
<i>Individual-Level Constraints</i>			
4.	Low Digital Proficiency	55.12	6
5.	Fear of Technology	38.63	14
6.	Physiological problems (e.g. eye strain) related to technology use	40.66	13
<i>Social and Cultural Constraints</i>			
7.	Lack of Local Mentorship	56.03	3
8.	Cultural Barriers	41.95	11
<i>Educational Constraints</i>			
9.	Limited Training Opportunities	64.66	1
10.	Language Barriers in Training Materials	48.4	10
<i>Technological Constraints</i>			
11.	Complex Digital Interfaces	54.82	7
<i>Policy and Institutional Constraints</i>			
12.	Limited government initiatives for promoting digital adoption in agriculture	55.35	4
13.	Non-Customized Programs	55.27	5
<i>Psychological Constraints</i>			
14.	Low Motivation Levels	50.59	9
15.	Dependence on Others/ family members	51.78	8

by Landmann et al., (2021). Lower-ranked constraints included cultural barriers (41.95), unstable network infrastructure (41.75), physiological challenges such as eye strain (40.66), fear of technology (38.63), and limited internet penetration (33.77). While these were not considered as critical as training or cost-related issues, they still contribute to digital exclusion, consistent with the findings of Ziegler (2021) and Rahman et al., (2023), who noted that both

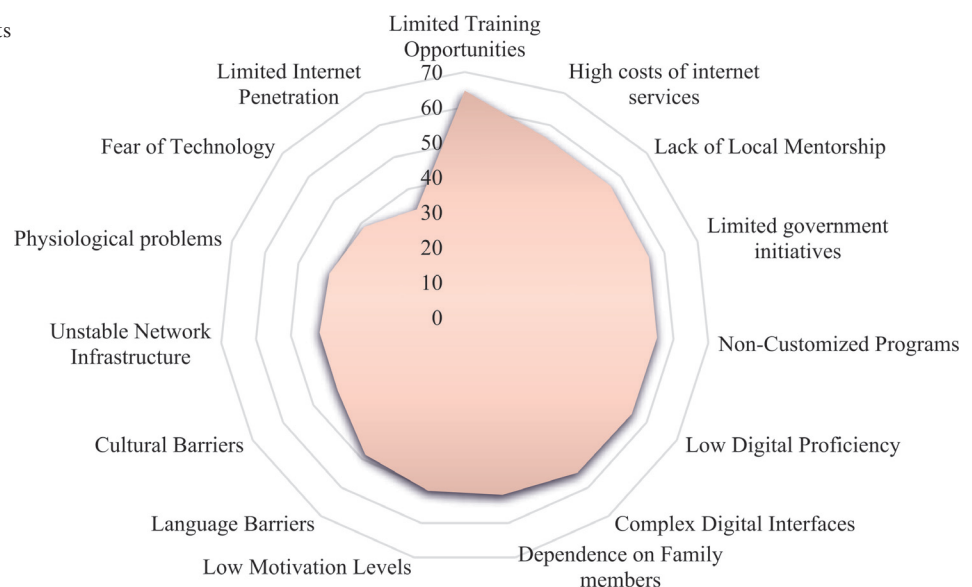
infrastructural and psychological limitations hinder rural women's ability to fully engage with digital technologies.

The radar chart (Figure 1) further illustrates how these constraints cluster into seven dimensions—educational, economic, social and cultural, technological, policy and institutional, infrastructural, and psychological. Educational and economic constraints were ranked highest, followed by policy-related barriers, suggesting that skill-building and affordability are the most immediate areas requiring intervention.

DISCUSSION

Educational barriers dominate the findings, with limited training opportunities emerging as the foremost constraint. This supports Mittal et al., (2017) & Kumar et al., (2025), who emphasise that the absence of structured and context-specific programmes restricts women farmers from acquiring essential digital competencies. Landmann et al., (2021) also note that without targeted training, rural women remain excluded from meaningful digital participation, highlighting the need for farmer-centred and localised learning approaches. Economic barriers, particularly the high cost of internet services, further intensify exclusion. As Mukherjee et al., (2023) observe, affordability strongly determines access to digital technologies in rural India. Unless addressed through subsidised data packages, public Wi-Fi facilities, or community-based digital hubs, financial barriers continue to prevent smallholders and women farmers from sustained engagement with digital tools.

Social and cultural factors add another layer of exclusion. The absence of mentorship and women's dependence on family members reduces autonomy, reflecting the gendered dynamics described by Sen (2015); Chakraborty & Gupta (2019). Establishing peer-led literacy groups and community mentors could provide role models and context-specific guidance. Institutional shortcomings aggravate the problem, as limited government initiatives and non-customised programmes often fail to align with grassroots realities. Heeks (2018) warns that standardised interventions rarely succeed without local adaptation, while Priambodo et al., (2024) find that women benefit more from programmes designed to meet their specific needs.

Figure 1. Radar chart of ranked constraints to digital literacy among JLG women farmers in Kerala

Technological, psychological, and infrastructural barriers further constrain digital adoption. Complex interfaces, fear of technology, and low motivation reduce women's confidence, as highlighted by Schnebelin (2022); Ziegler (2021) & Rahman et al., (2023). Meanwhile, unstable connectivity and limited internet penetration remain challenges in remote regions of Kerala despite initiatives such as KFON. Addressing these interconnected barriers requires integrated, gender-sensitive strategies that combine affordable internet, farmer-oriented training, peer mentorship, and inclusive extension services. Such interventions are essential for enabling women farmers to leverage digital technologies for improved productivity, market access, and empowerment in Kerala's agrarian economy.

CONCLUSION

The digital literacy among JLG women farmers in Kerala is constrained by multiple interlinked factors spanning educational, economic, social, technological, institutional, psychological, and infrastructural dimensions. Limited training opportunities and high internet costs emerge as the most critical barriers, followed by inadequate mentorship, low digital proficiency, and poorly aligned institutional initiatives. While infrastructural challenges such as unstable connectivity and limited internet penetration remain important, socio-cultural restrictions and low motivation further reduce women's autonomy in digital adoption. Addressing these constraints requires integrated, gender-sensitive, and context-specific strategies that combine affordable internet access, skill-building through localised training, community-based mentorship, and inclusive policy support. By strengthening digital capacities, women farmers can more effectively engage with agricultural technologies, improve productivity, and enhance resilience in Kerala's agrarian economy. Bridging the gendered digital divide is therefore essential not only for empowering women but also for ensuring equitable and sustainable agricultural development.

DECLARATIONS

Ethics approval and informed consent: Informed consent was sought from the respondents during the course of the research.

Conflict of interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare that during the preparation of this work, thoroughly reviewed, revised, and edited the content as needed. The authors take full responsibility for the final content of this publication.

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