



Development of a Scale to Assess Kerala Farmers' Attitude towards Digital Technologies in Agriculture

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HIGHLIGHTS

- A standardized 20-item attitude scale was developed to assess farmers' attitudes towards digital technologies in agriculture, resulting in a reliability coefficient of 0.91.
- The key elements of digital competency, comprising both positive and negative statements, were finalized by selecting items that had critical ratio t-values of at least 1.75.
- The developed attitude scale is appropriate for evaluating the attitude of farmers towards digital technologies and supporting digital agriculture efforts.

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ABSTRACT

The expanding role of digital technologies in agriculture highlights the importance of understanding farmers' attitudes toward their adoption, particularly in the context of Kerala's digital infrastructure and e-governance. The research, carried out in 2025, sought to create a standardized Likert attitude scale to evaluate the attitude of Kerala farmers on the employment of digital technologies in agriculture. A preliminary collection of 68 attitude statements was formed through literature research and expert input. These statements were assessed by 30 specialists in agricultural extension, and following their feedback, 56 items were chosen for further analysis. The chosen items were distributed to 60 farmers from non-sample regions-30 from Karuvatta Panchayat and 30 from Kayamkulam Municipality, situated in the Onattukara Sandy Plain agro-ecological unit. Participants rated the statements using a five-point Likert scale. Employing the t-test established by Edwards (1957, 1969), statements with strong discriminative ability were retained, resulting in a final scale of 20 items comprising 10 positive and 10 negative statements, achieving a Cronbach's Alpha of 0.91, which demonstrates excellent reliability and content validity confirmed through expert assessment.

INTRODUCTION

The integration of digital technologies has become an essential component of modern agricultural practices across the globe. Tools such as mobile apps, AI-based advisory systems, remote sensing, GPS-enabled devices, and digital platforms now enable farmers to access real-time information, improve the efficient use of resources, and expand their access to markets (Chander et al., 2022). In India,

the agricultural sector is slowly evolving into the digital era, aided by governmental initiatives such as Digital India, AgriStack, e-NAM, and Kisan Sarathi, which seek to digitize services and provide farmers with timely and localized advice (GoI, 2024).

India's digital landscape is rapidly expanding. According to the Internet and Mobile Association of India (IAMAI, 2023), by mid-2022, the country had over 759 million people actively using the internet, with nearly 400 million of these users residing in rural

areas. Remarkably, Kerala is one of the leading states in India, distinguishes itself with high digital literacy, almost universal mobile phone usage, and more than 70 per cent internet penetration in its rural regions (TRAI, 2023). The state has achieved significant advancements through the Kerala Fibre Optic Network (KFON) initiative, aiming to offer free internet access to 2 million households, thereby enhancing its digital foundation.

Despite these advancements, the uptake of digital technology in agriculture is still limited, especially among small and marginal farmers, who make up the majority in Kerala. These farmers often depend on traditional knowledge sources in agriculture, like Krishi Bhavans, fellow agriculturalists, and input suppliers, and are less inclined to engage with digital advisory services due to reasons such as a lack of trust, language issues, limited exposure, or the perceived complexity of digital solutions (Harilal & Eswaran, 2015). Research conducted by Jena et al., (2024) has shown that digital competence is essential in influencing the capacity of extension personnel and farmers to incorporate technology into their practices.

In agriculture, a farmer's attitude toward digital technologies significantly influences their willingness and ability to adopt and utilize such tools. Fishbein & Ajzen (1975) further assert that attitude plays a key role in shaping behavioural intention, which in turn drives actual behaviour. To address this shortcoming, the current study employs the Digital Competency Framework developed by Ferrari & Punie (2013), which identifies five key components of digital competence pertinent to farmers. The first component, information, refers to the capability to locate, evaluate, and utilize digital agricultural information; the second, communication, pertains to engaging with peers, experts, and markets through digital channels; the third, continuous learning, indicates the ability to adjust to emerging technologies and improve digital skills; the fourth, technology adoption, signifies the willingness to accept and incorporate innovative digital solutions into farming methods; and the fifth, problem solving, involves the proficient use of ICT tools to identify and tackle farming-related challenges. By incorporating these elements into the measurement tool, the study aims to create a thorough, context-specific, and standardized instrument for assessing farmers' attitude towards the utilization of digital technologies in agriculture.

METHODOLOGY

The goal of this study was to develop a standardized scale to evaluate the attitude of farmers in Kerala regarding the use of digital technologies in agriculture. The research utilized the well-established Likert summated rating method (Likert, 1932), which is appropriate for evaluating psychological constructs like attitude (Thurstone, 1946). The research was conducted in Karuvatta Panchayat and Kayamkulam Municipality within Agro Ecological Unit 3: Onattukara Sandy Plain of the Coastal Plain Zone, involving a sample of 60 farmers (30 from each location). Initially, 68 attitude statements were compiled based on existing literature and expert opinions, addressing five elements of the Digital Competency Framework-Information, Communication, Problem Solving, Continuous Learning, and Technology Adoption. The relevance of these statements was assessed by 30 judges in the field of agricultural extension, retaining those with a Relevancy Weight

(≥ 0.843), Relevancy Percentage ($\geq 84.29\%$), and Mean Relevancy Score (≥ 4.215). This evaluation led to the selection of 56 statements for further item analysis.

These 56 statements were presented to the 60 farmers using a five-point Likert scale. The respondents were classified according to their total scores, identifying the top 25% (high group) and bottom 25% (low group) for conducting a critical ratio (t-value) analysis following Edward's (1957) methodology. Only the statements with t-values ≥ 1.75 were included, which resulted in a final scale of 20 items. To evaluate the internal consistency of the scale, Cronbach's Alpha was computed and yielded a value of 0.91, indicating excellent reliability. The validity of the scale was established through expert evaluation and comprehensive coverage of the five dimensions of digital competency. Therefore, the scale produced through this meticulous approach is both reliable and valid for evaluating farmers' attitude towards the adoption of digital technologies in agriculture.

RESULTS

The development of an attitude scale aimed at assessing Kerala farmers' attitude regarding the use of digital technologies in agriculture adhered to established psychometric methods, which included relevancy testing, item analysis, reliability assessment, and verification of validity.

Relevancy test

An initial set of 68 attitude statements was rated for relevancy by 30 Agricultural Extension experts using a five-point scale, and the results were computed using the following equations;

$$\text{Relevancy Weightage (RW)} = \frac{[(\text{MOR} \times 5) + (\text{MR} \times 4) + (\text{R} \times 3) + (\text{LR} \times 2) + (\text{NR} \times 1)]}{\text{Maximum possible score}}$$

$$\text{Relevancy Percentage (RP)} = \frac{[(\text{MOR} \times 5) + (\text{MR} \times 4) + (\text{R} \times 3) + (\text{LR} \times 2) + (\text{NR} \times 1)]}{\text{Maximum possible score}} \times 100$$

$$\text{Mean Relevancy Score (MRS)} = \frac{[(\text{MOR} \times 5) + (\text{MR} \times 4) + (\text{R} \times 3) + (\text{LR} \times 2) + (\text{NR} \times 1)]}{\text{Number of judges responded}}$$

MOS = Most Relevant, MR = More Relevant, LR = Less Relevant, NR = Not Relevant

Maximum Possible Score = Total number of judges $\times$ Maximum score per item = $30 \times 5 = 150$, Number of judges responded = 30

Criteria with MRS ≥ 4.215 , RP $\geq 84.29\%$, and RW ≥ 0.843 were chosen for the subsequent phase, while items that were repetitive or overlapped were either rephrased or omitted as advised by experts.

Item analysis

To create a dependable and valid attitude scale, conducting an item analysis is an essential process, as explained in Likert's scaling method. This technique determines how effectively individual statements can distinguish between respondents with positive and negative attitudes. After completing the relevance assessment, 56 statements related to attitudes were preserved and presented to 60 farmers from non-sample regions in Karuvatta Panchayat and Kayamkulam Municipality, which are situated in Agro Ecological

Unit (AEU) 3: Onattukara Sandy Plain within the Coastal Plain Agro Ecological Zone (AEZ) of Kerala.

Using a five-point Likert scale, participants reported their degree of agreement. After computing the overall attitude score for each individual, farmers were ranked from highest to lowest. The top 25% (20 farmers) and bottom 25% (20 farmers) were retained as criterion groups for item analysis, while the middle 50% were excluded, consistent with Edwards' (1957) procedure. The critical ratio (t-value) for each statement was then calculated using the Edwards (1969) method to determine discriminative effectiveness:

$$t = (X_H - X_L) / \sqrt{S_H^2/n_H + S_L^2/n_L}$$

Where, X_H = Mean score of the item for the high group

X_L = Mean score of the item for the low group

S_H = Variance of the high group for the item

S_L = Variance of the low group for the item

n_H & n_L = Number of respondents in high and low groups, respectively (in this case, 20 each)

Following the criteria established by Bird (1940), statements yielding a t-value below 1.75 were removed due to inadequate discriminatory power. Ultimately, items that achieved t-values ≥ 1.75

were chosen for inclusion in the final attitude scale. These items displayed a strong ability to differentiate between favourable and unfavourable respondents and were, therefore, deemed valid for evaluating farmers' attitudes towards digital technologies in agriculture. Consequently, the final standardized attitude scale consisted of 20 highly discriminating items with 10 positive and 10 negative statements, which together capture the varied views of Kerala farmers on the use of digital technology in agriculture.

Reliability of the scale

To ensure the robustness of the final attitude scale measuring farmers' attitudes toward the use of digital technologies in agriculture, its reliability was tested using Cronbach's Alpha. The resulting value of about 0.91 signifies excellent internal consistency, demonstrating that the items work cohesively to reflect the targeted construct.

Validity of the scale

Content validity was ensured through detailed expert judgment. A group of thirty experts assessed and rated the clarity and relevance of each item. Changes were implemented in response

Table 1. Final statements to assess farmers' attitude towards digital technologies in agriculture along with "t" values

Statements	Relevancy Percentage	Mean Relevancy Score	t-value
Information			
Identifying crop-specific pest and disease management practices is easier with ICTs	0.873	4.37	3.07
I believe farmers can efficiently access agricultural data through digital platforms despite language barriers, technical jargon, and complex interfaces (-)	0.867	4.33	2.19
Retrieval of multimedia information, like videos, benefits farmers more than text-based content	0.867	4.33	3.36
I believe digital platforms are necessary for the future growth of agriculture	0.906	4.53	2.04
Communication			
ICTs help farmers communicate with experts in real-time	0.853	4.27	3.65
ICT-based platforms promote transparent communication with stakeholders	0.886	4.43	1.78
Only resourceful farmers can fully benefit from the advantages of digital platforms (-)	0.853	4.27	2.43
Sharing successful farming practices on social media can create unrealistic expectations, pressuring farmers to adopt practices that may not suit (-)	0.86	4.3	2.78
Social media platforms are useful tools for farmers to share experiences and learn from others	0.853	4.27	1.95
I believe technology-driven agriculture benefits those with digital skills, putting traditional farmers at a disadvantage (-)	0.866	4.33	3.65
Technology Adoption			
ICTs facilitate easy access to agricultural credit and crop insurance	0.866	4.33	2.88
Farmers avoid mobile banking due to security fears, mistrust, and lack of awareness	0.88	4.4	3.96
Agricultural portals overwhelm farmers with excessive information, making decision-making difficult (-)	0.846	4.23	1.78
Continuous Learning			
I believe farmers can effectively apply online knowledge from ICTs even without hands-on, localized training (-)	0.866	4.33	2.19
Training on ICT tools increases farmers' confidence in their usage	0.853	4.27	2.44
I believe online communities and groups are well-moderated and provide accurate information, maintaining farmers' trust and supporting their decision-making (-)	0.846	4.23	2.20
Problem Solving			
ICT platforms identify the best practices tailored to local requirements	0.873	4.36	3.36
ICT based tools are best suited to value added services such as railway tickets, e-governance rather than providing agricultural information (-)	0.86	4.3	2.57
Digital platforms fail to bridge the gap, leaving remote farmers disconnected from the agricultural mainstream (-)	0.846	4.23	3.42
The transition to ICT-based extension services may exclude farmers who rely on face-to-face interactions, widening the knowledge gap for those unfamiliar with technology (-)	0.88	4.4	3.07

to their feedback. Given that the scale covers various facets of digital competency in agriculture and has been reviewed by experts, it is viewed as having robust content validity. The scale effectively measures what it purports to measure—the attitude of Kerala farmers towards digital technologies in agriculture.

DISCUSSION

In this research, we aimed to create and validate a standardized tool for measuring farmers' attitude regarding the adoption of digital technologies in agriculture. The study adopted a structured process of item generation, expert validation, and statistical analysis, consistent with methods used by Shitu et al., (2018); Chandra et al., (2024) & Vavilala et al., (2024). Iterative refinement, as emphasized by Gupta et al., (2023) & Kour et al., (2025), further ensured the scale's validity and contextual relevance. The developed scale demonstrated excellent internal consistency, with Cronbach's alpha at 0.91, confirming that the items measured the same underlying construct, similar to the robustness established by Sandeep et al., (2023) in digital agricultural services. Its validity, ensured through content validation and expert refinement, reflects the methodological rigor seen in Reddy et al., (2023) on climate-resilient dairy farming, thereby strengthening confidence in the tool's reliability and relevance.

The present scale also adds new value to the existing body of ICT-related attitude measures in agriculture. Earlier instruments focused on farmers' general attitude towards ICT use (Samatha et al., 2012), ICT-based extension services (Kumar & Ratnakar, 2011), or the perceptions of agricultural scientists (Pal et al., 2023). However, none effectively captured the multi-dimensional construct of digital competency. The current scale addresses this gap by integrating key dimensions such as information use, communication, technology adoption, continuous learning, and problem-solving. By doing so, it moves beyond binary measurement of positive or negative perceptions to assess the breadth of attitude and skill necessary for effective digital engagement in agriculture. Consequently, it serves as a practical tool for academic research, extension evaluations, and policy planning, particularly in benchmarking farmers' readiness for digital agriculture in Kerala. Despite its strengths, the scale is not without limitations. The reliance on content validity alone, while ensuring expert consensus, may restrict the generalizability of the results beyond the study region. Moreover, validation was conducted only within selected regions of Kerala, which may not reflect the diversity of India's farming contexts. The rapid and dynamic evolution of digital technologies also means that the items included in the scale may require periodic revision to remain relevant. Furthermore, prior standardization concerns caution against applying the tool directly outside India without additional testing. Nonetheless, these limitations provide opportunities for future research. Cross-regional testing, longitudinal studies, and the incorporation of qualitative insights could significantly enhance the robustness and applicability of the scale across diverse contexts. Overall, the final instrument offers a statistically sound and contextually appropriate means to evaluate farmers' attitudes towards digital technologies in agriculture, ensuring both academic utility and practical application in extension systems.

CONCLUSION

With the growing emphasis on digital transformation in agriculture, understanding farmers' attitudes towards digital technologies is essential for successful implementation and policy planning. The standardized attitude scale created in this study is specifically aimed at farmers in Kerala and provides a scientifically validated instrument for evaluating their attitude and willingness to adopt digital tools in agriculture. Developed through careful and systematic procedures that included expert validation, item analysis, and reliability testing, this scale achieved a high Cronbach's Alpha of approximately 0.91, signifying excellent internal consistency. Researchers, policymakers, and extension professionals can utilize this tool to carry out baseline surveys and make well-informed choices that promote the adoption of digital technologies in agricultural practices. Due to its strength and relevance in the context of agricultural digitalisation, this scale promises broader use in similar agro-ecological environments.

DECLARATIONS

Ethics approval and informed consent: The experts to judge the items were well informed regarding the purpose and only the responses of the judges who consented have been included for analysis purpose.

Conflict of interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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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REFERENCES

- Bird, C. (1940). *Social psychology*. Appleton Century Crofts.
- Chander, M., Sagar, R. L., & Sulaiman, R. V. (2022). Digital extension services in Indian agriculture: Innovations, impact, and insights. *Indian Journal of Extension Education*, 58(2), 1-8.
- Chandra, S., Ghadei, K., Chennamadhava, M., & Ali, W. (2024). Development and validation of a farmer's focused digital literacy scale. *Indian Journal of Extension Education*, 60(1), 111–115. <https://epubs.icar.org.in/index.php/IJEE/article/view/142948>
- Edward, A. L. (1957). *Techniques of attitude scale construction*. Vakils, Feffer and Simons Inc.
- Edwards, A. L. (1969). *Techniques of attitude scale construction*. Vakils and Simon Private Ltd.
- Ferrari, A., & Punie, Y. (2013). *DIGCOMP: A framework for developing and understanding digital competence in Europe*. Joint Research Centre of the European Commission. <https://publications.jrc.ec.europa.eu/repository/handle/JRC83167>

- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behaviour: An introduction to theory and research*. Addison-Wesley. <https://people.umass.edu/ajzen/f&a1975.html>
- Government of India (GoI). (2024). *Digital Agriculture Mission: Tech for Transforming Farmers' Lives*. Ministry of Agriculture and Farmers Welfare. <https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=2051719>
- Gupta, S. K., Nain, M. S., Singh, R., & Mishra, J. R. (2022). Development of scale to measure agripreneurs attitude towards entrepreneurial climate, *Indian Journal of Extension Education*, 58(2), 153-157. <http://doi.org/10.48165/IJEE.2022.58237>
- Harilal, K. N., & Eswaran, K. (2015). *Agriculture in Kerala: Trends and prospects*. Kerala State Planning Board Discussion Paper. https://cds.edu/wp-content/uploads/RULSG3_Harilal.pdf
- Internet and Mobile Association of India (IAMAI). (2023). *Internet in India Report 2023*. <https://www.iamai.in>
- Jena, P., Saryam, M., Tigga, A. S., Sah, A. K., Kumar, S., Dei, S., & Kumar, M. (2024). Analytical study on digital competency among farmers of Indo-Gangetic Plain: Special reference to socio-personal & techno-economic attributes. *Ecology, Environment and Conservation*, 30(3), 1127-1136. <http://doi.org/10.53550/EEC.2024.v30i03.025>
- Kour, R., Slathia, P. S., Peshin, R., Singh, A. P., Sharma, M., & Kumar, R. (2025). Scale to measure the attitude of farmers towards the maize and wheat crops. *Indian Journal of Extension Education*, 61(3), 109-112. <https://doi.org/10.48165/IJEE.2025.613RT04>
- Kumar, P. G., & Ratnakar, R. (2011). A scale to measure farmers' attitude towards ICT-based extension services. *Indian Research Journal of Extension Education*, 11(1), 109-111. <https://api.seea.org.in/uploads/pdf/v11123.pdf>
- Likert, R. A. (1932). A technique for the measurement of attitude. *Archives of Psychology*, 22(140), 1-55.
- Pal, A., Singh, D., & Mohapatra, L. (2023). A standardized scale to measure attitude of agricultural scientists towards ICT. *Asian Journal of Agricultural Extension, Economics & Sociology*, 41(9), 37-44. [10.9734/ajaees/2023/v41i92012](https://doi.org/10.9734/ajaees/2023/v41i92012)
- Reddy, D. A. K., Garai, S., Maiti, S., Manjunath, K. V., Panja, A., & Sahani, S. (2023). Construction of scale to measure women farmers' attitude towards climate-resilient dairy farming practices. *Indian Journal of Extension Education*, 59(3), 150-153. <https://doi.org/10.48165/IJEE.2023.59327>
- Samatha, J., Vijayabhinandana, B., & Krishna, T. G. (2012). A scale to measure attitude of farmers towards information and communication technologies (ICTs) use. *The Andhra Agricultural Journal*, 59(1), 150-153. https://aaj.net.in/wp-content/uploads/2024/05/2012_article_591-33.pdf
- Sandeep, P. G., Ganesamoorthi, S., Raghuprasad, K. P., Gowda, V. G., Benherlal, P. S., & Mohan Kumar, T. L. (2023). Exploring stakeholder attitudes towards digital agricultural communication and services. *Indian Journal of Extension Education*, 59(4), 91-96. <https://doi.org/10.48165/IJEE.2023.59419>
- Shitu, G. A., Nain, M. S., & Kobba, F. (2018). Development of scale for assessing farmers' attitude towards precision conservation agricultural practices. *Indian Journal of Agricultural Sciences*, 88(3), 499-504.
- Telecom Regulatory Authority of India (TRAI). (2023). *Indian Telecom Services Performance Indicator Report*. <https://traai.gov.in>
- Vavilala, P., Singh, V. K., Singh, D. K., & Singh, L. B. (2024). Attitude of the staff towards Farmer Producers Organization – Development and standardization of the scale. *Indian Journal of Extension Education*, 60(1), 116-119. <https://doi.org/10.48165/IJEE.2024.601RT2>