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Exploring Stakeholder Attitudes towards Digital Agricultural Communication and Services

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ABSTRACT

Digital agricultural communication and services enhance agricultural production by delivering real-time data, information, and support to stakeholders, thereby substantially extending the reach and impact of agricultural extension. The study, conducted in 2023, encompassed all three agro-climatic zones within Telangana and employed an ex post facto research design. Data collection involved personal interviews with a sample size of 180 farmers, 30 input dealers, 30 extension personnel, and 30 scientists. The study found that more than half (57.04%) of the overall sample expressed favorable attitudes toward digital agricultural communication and services. Mean attitude scores varied, with scientists scoring the highest (172.87), followed by farmers (169.23), extension personnel (166.37), and input dealers (165.23). Regression analysis using selected independent variables produced R^2 values of 0.789 for farmers, 0.805 for input dealers, 0.720 for extension personnel, and 0.870 for scientists, indicating the effectiveness of the chosen independent variables in explaining changes in the dependent variable. These findings indicate the favourable attitude of stakeholders towards digital agricultural communication and services, laying a strong foundation for advancing digitalization in agriculture. This could enhance information dissemination and service improvements in the agricultural ecosystem.

INTRODUCTION

In an era where digitalization is reshaping industries and societies, its impact on agriculture, a vital sector, cannot be underestimated. Digitalization shapes modern society, impacting business and daily life (Hagberg et al., 2016). Digitalization innovates work, creates jobs, and boosts economies (Shallu et al., 2019). Digitalization employs ICT, including AI, IoT, and the fourth industrial revolution (Morley et al., 2018). Digital empowerment accelerates development through enhanced human resource utilization (Dutta & Jeerh, 2023). Integrating digital tech in Indian agriculture is pivotal, with potential to revolutionize. It offers real-time info, expert advice, e-Services for efficient government delivery, reducing corruption, boosting transparency, convenience, and citizen empowerment (Dutta & Devi, 2015). Digitalization involves implementing digital technologies in individuals, organizations, or society (Brennen & Kreiss, 2016). Effective agricultural knowledge systems empower Indian farmers with vital information for informed decisions and farmers primarily rely on strong informal ties for accessing agricultural information

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and services (Singh et al., 2023). Digital tools like mobile apps, IVR, Digital Kiosk, and social media enhance system efficiency and effectiveness (Rai, 2023). Digital communication transforms access to agricultural advisory services, bridging gaps between small-scale farmers and emerging markets (Zolkepli & Kamarulzaman, 2015). The integration of ICT in agriculture is a pivotal element of agricultural extension, aiming to advance rural and agricultural development through enhanced communication and information procedures (Dhaka & Chayal, 2010). The declining smartphone costs and budget-friendly options have broadened technology access. Social media's growing role in general and agricultural discourse is evident, with content aligning with user needs and user-friendly interfaces on these platforms (Nain et al., 2019; Sandeep et al., 2022).

In India's journey towards a digitally empowered future, initiatives like "Digital India" and digital agricultural platforms are shaping the trajectory of agricultural progress. Telangana stands out as a trailblazer, conducting a significant portion of its agricultural operations digitally. Innovative platforms in Telangana have transformed agricultural communication and services, benefiting stakeholders. These initiatives include "Mee-Seva" a platform that empowers citizens through smart governance, making government services easily accessible. "Dharani Integrated Land Records" has modernized agricultural land registration, ensuring transparency and efficiency. The "Rythu Bandhu and Rythu Bheema Portals" facilitates the registration and distribution of farm investment and life insurance support to farmers. The "Integrated Information Dissemination System (IIDS)" offers agricultural advisory services, while the "Online License Management System (OLMS)" streamlines processes of license issue. "OSSDS" (Online Subsidy Seed Distribution System) transforms agricultural seed distribution, and "Weather Based Agro-Advisory Services (WBAAS)" provides farmers with crucial weather intelligence. Agricultural institute social media initiatives are revolutionizing information dissemination, while mobile apps are underscored for efficient agriculture department management. Together, these digital platforms empower stakeholders, streamline processes, and enhance transparency, fostering agriculture's growth in Telangana. Given the pivotal role of digitalization in agricultural communication and services, examining stakeholders' attitudes towards digital agricultural communication and services is of paramount importance, as these attitudes have a direct and profound influence on the effective utilization of these digital initiatives. The success of any digital transformation in agriculture hinges on the willingness and enthusiasm of key stakeholders to embrace and integrate these technologies into their daily practices.

METHODOLOGY

The present study was conducted purposively within the state of Telangana during the months of March to June in 2023. Two districts from each agro climatic zones (ACZs) having at least one KVK selected by using random sampling. A total of thirty farmer respondents, along with five input dealers, five extension personnel, and five scientists from each districts, were chosen using a simple random sampling approach. The sample size included 60 farmer respondents from each ACZ, 10 input dealers from each ACZ, 10 extension officers from each ACZ, and 10 scientists engaged in extension work from each ACZ. As a result, the comprehensive sample comprised 270 respondents. The ex-post facto research design was used for current investigation. Attitude in the study was operationalized as extent of favorable or unfavorable feelings expressed by respondents concerning the usability, responsiveness, quality, personalization, system availability, efficiency, and satisfaction associated with digital agricultural communication and services. A comprehensive attitude scale was constructed with six dimensions which was found statistically reliable (r = 0.867) and valid ($\sqrt{r_{11}}$ = 0.931) was used for the study. The scale constitutes forty-eight statements was measured on five-point continuum i.e., strongly agree, agree, undecided, disagree, strongly disagree with score of 5,4,3,2,1 respectively for positive statements and inversely for negative statements. Primary data was gathered from all three ACZs with in Telangana. Mean and standard deviation was used to classify categories of least favorable, favorable and most favorable categories. The Kruskal wall is test was used to identify the significant difference among stakeholder's attitude levels. Spearman rank correlation (p value) was used to identify the relationship between attitude levels and profile characteristics. Regression analysis was carried out to check the extent of contribution of profile characteristics to attitude levels of digital agricultural communication and services.

RESULTS AND DISCUSSION

From Table 1, it can be observed that more than half (56.11%) of farmers respondents had most favorable levels of attitude towards usability dimension, favorable levels (69.44%) was observed in responsiveness dimension, most favorable (52.22%) in quality dimension, least favorable (55.00%) in personalization, favorable levels (46.67%) in system availability and efficiency dimension, and favourable levels (52.48%) was observed as high frequency categories in satisfaction dimension. In case of input dealers' favorable levels (63.33%) observed as majority in usability dimension, least favourable levels (63.33%) in responsiveness dimension, favorable levels (83.33%) in quality dimension, favorable levels (63.33%) in personalization dimension, favorable levels (90.00%) in system availability and efficiency dimension, and favorable levels (83.33%) was observed in satisfaction dimension. In the sample of extension personal favorable levels (76.67%) was observed as majority in usability dimension, favorable levels (83.33%) in responsiveness, most favorable levels (80.00%) in quality, favourable levels (76.67%) in personalization, favorable levels (83.33%) in both system availability and efficiency dimension and satisfaction dimension. Among scientists, most favorable levels (36.67%) were observed in usability, favorable levels (60.00%) were observed in responsiveness, most favorable levels (60.00%) in quality dimension, most favorable (50.00%) in personalization, favorable levels (63.33%) in system availability and efficiency and favorable levels (60.00%) as high frequency groups in satisfaction. The dimension quality ranked top among famer sample with mean score of 3.71, followed by usability (3.64), satisfaction (3.55), system availability and efficiency (3.42), responsiveness (3.39)

Table 1. Dimension wise distribution of Stakeholders in attitude towards digital agricultural communication and services

S.No.	Characteristics	Category	Famers (n=180) %	Mean Rank	Input dealers (n=30) %	Mean Rank	Extension personnel (n=30) %	Mean Rank	Scientists (n=30) %	Mean Rank
1.	Usability (Mean 32.50 ½ S.D 0.99)	Less favourable < 31.51	12.78	3.64 (II)	20.00	3.63 (II)	10.00	3.49 (III)	33.33	3.66 (II)
		Favourable 31.51 – 33.49	31.11		63.33		76.67		30.00	
		More favourable > 33.49	56.11		16.67		13.33		36.67	
2.	Responsiveness (Mean 23.73 ½ S.D. 0.85)	Less favourable > 22.88	12.22	3.39 (V)	63.33	3.33 (VI)	13.33	3.32 (VI)	06.67	3.49 (VI)
		Favourable 22.88 – 24.58	69.44		16.67		83.33		60.00	
		More favourable > 24.58	18.33		20.00		03.33		33.33	
3.	Quality (Mean 29.61 ½ S.D. 0.83)	Less favourable < 28.78	11.11	3.71 (I)	10.00	3.68 (I)	06.67	3.71 (I)	10.00	3.78 (I)
		Favourable 28.78 – 30.44	36.67		83.33		13.33		30.00	
		More favourable > 30.44	52.22		06.67		80.00		60.00	
4.	Personalization (Mean 23.80 ½ S.D. 0.90)	Less favourable > 22.90	55.00	2.98 (VI)	16.67	3.34 (V)	06.67	3.38 (IV)	06.67	3.51 (V)
		Favourable 22.90 – 24.70	13.33		63.33		76.67		43.33	
		More favourable > 24.90	31.67		20.00		16.67		50.00	
5.	System availability and efficiency (Mean 30.77 ½ S.D. 1.20)	Less favourable < 29.58	29.44	3.42 (IV)	10.00	3.35 (IV)	06.67	3.35 (V)	06.67	3.52 (IV)
		Favourable 29.58 -31.97	46.67		90.00		83.33		63.33	
		More favourable > 31.97	23.89		00.00		10.00		30.00	
6.	Satisfaction (Mean 28.34 ½ S.D 1.04)	Less favourable < 27.30	23.33	3.55 (III)	03.33	3.48 (III)	10.00	3.59 (II)	13.33	3.63 (III)
		Favourable 27.30 – 29.39	52.48		83.33		83.33		60.00	
		More favourable > 29.39	23.89		13.34		06.67		26.67	

and least ranked was personalization (2.98). The dimension quality ranked top with the mean score of 3.68 in input dealers, followed by usability (3.63), satisfaction (3.48), system availability and efficiency (3.35), personalization (3.34), and responsiveness (3.33). Again, quality was observed as top dimension among extension personnel with mean score of 3.71, followed by satisfaction (3.59), usability (3.49), personalization (3.38), system availability and efficiency (3.35) and least ranked was responsiveness (3.32). The dimension quality ranked top with the mean score of 3.78, followed by usability (3.66), satisfaction (3.63), system availability and efficiency (3.52), personalization (3.51) and dimension ranked least was responsiveness (3.49).

The analysis of stakeholder attitudes towards digital agricultural communication and services under various dimensions provides valuable insights into their preferences. Across various dimensions, the responses highlighted distinct patterns within different stakeholder groups. The dimension of quality consistently emerged as the top-ranking factor among farmers, input dealers, extension personnel, and scientists, indicating its universal importance. This suggests that stakeholders highly value the reliability, effectiveness, and overall excellence of digital agricultural services. The usability dimension was consistently ranked favorably, showcasing the significance of user-friendly interfaces and easy navigation in enhancing stakeholders' experiences. Satisfaction also garnered positive ratings, emphasizing the importance of meeting stakeholder expectations and ensuring their contentment with the services provided. The dimensions of system availability and efficiency were moderately rated, underlining the significance of accessible and efficient digital platforms in supporting stakeholders' needs. Personalization and responsiveness, however, appeared as dimensions that were less favored suggesting need to focus on tailoring services to individual preferences and improving response times to ensure stakeholders feel valued and adequately supported.

From Table 2 it can be observed that majority of the farmers had favourable levels (65.00%) of attitude towards digital agricultural communication and services, followed by most favorable levels (18.33%) and least favourable levels (16.67%). Favourable levels (53.33%) were observed as majority in input dealers, followed by least favourable (26.67%) and most favorable (20.00%). Most favorable levels (50.00%) as high frequency group among extension personnel, followed by favourable levels (33.33%) and least favorable levels (16.67%). Most favorable levels (56.66%) observed as majority among scientists, followed by favourable levels (36.67%) and least favourable levels (06.67%). In overall sample the majority belonged to favourable levels (57.04%), followed by most favourable levels (26.30%) and least favourable levels (16.67%). A similar trend was reported by Reddy et al., (2017); Panda et al., (2019), Panda et al., (2019b); Nirmalkar et al., (2022) in attitude towards usage of Information Communication Tools.

Turning to the results from Table 2, it is evident that stakeholders generally hold favorable attitudes towards digital agricultural communication and services. The majority of farmers, input dealers, extension personnel, and scientists displayed either favorable or most favorable attitudes, indicating a positive overall attitude of these digital initiatives. This suggests that there is a growing recognition of the benefits and value that digital tools

Table 2. Overall attitude of stakeholders towards digital communication and services respondent wise

Category	Farmers (n_1=180) %	Input dealers (n_2=30) %	Extension Personnel (n_3=30) %	Scientists (n_4=30) %	Total (n=270) %	H value
Less Favourable (< 163.08)	16.67	26.67	16.67	06.67	16.67	
Favourable (163.08 – 174.41)	65.00	53.33	33.33	36.67	57.04	27.916**
More Favourable (> 174.41)	18.33	20.00	50.00	56.66	26.30	
Mean	169.23	165.23	166.37	172.87	168.74	
S.D.	12.15	5.85	5.94	12.96	11.34	

Mean 168.74 ½ S.D. 5.67** Significant at 1 % levels

bring to the agricultural sector. Stakeholders' attitudes could be positively influenced by offering personalized experiences. Implement features that allow users to customize their interactions with digital platforms based on their specific needs and preferences. Address the lower rankings in responsiveness by ensuring quick and effective responses to stakeholder inquiries, concerns, or feedback. This will contribute to a sense of importance and engagement among stakeholders. Use feedback from stakeholders to continuously refine and improve digital services. Demonstrating a commitment to addressing their needs will foster a sense of partnership and collaboration.

From Table 2 it can be observed that the mean (172.87) of scientists was top, followed by farmers (169.23), extension personnel (166.37) and input dealers (165.23). The Kruskal Wallis test used to identify any significant differences between that stakeholder's attitude. The H value was found to be 27.916 which is greater than the H critical value at both 5 pe cent (7.82) and 1% (11.34) levels of significance. Hence, it can be concluded that there is a significant difference in the attitude levels of stakeholders towards digital agricultural communication. The significant difference in attitude levels among stakeholders towards digital agricultural communication could be attributed to various factors. Scientists, likely more technologically oriented, may have higher expectations and appreciation for the benefits of digital communication. Farmers, primarily recipients of information and services, tend to be content and satisfied with the content and system responses. In contrast, extension personnel and input dealers, who actively engage with these digital systems, report subpar experiences, leading to lower attitudes. These varying roles and experiences contribute to the observed differences in attitudes. Recommendations to bridge the gap in attitudes toward digital agricultural communication among stakeholders include tailoring communication strategies, customizing content, and fostering collaboration among scientists, farmers, extension personnel, and input dealers. Providing digital literacy training, creating feedback mechanisms, and raising awareness can be instrumental in achieving this goal.

From Table 3 it was observed that age and professional experience was found negative and significant relationship with attitude towards digital agricultural communication and services among famers sample. The results are supported by Mahajan et al., (2022) and Chandra et al., (2023). The variable IT savvyness, orientation towards digitalization, innovativeness, achievement motivation, self-confidence, economic motivation and risk orientation was found positive and significant relationship with attitude towards digital agricultural communication and services among famers sample. The results are in support with Prasad & Pradhan (2019) and Chandra et al., (2023). R^2 value was found 0.789 in farmers sample indicating that, the 78.90 per cent variation in the attitude towards digital communication and services was explained by selected independent variable.

The variable age, orientation towards digitalization, innovativeness and economic motivation was found significantly contributing to attitude levels of farmers was observed in regression analysis. Based on the observed results, it is suggested that include promoting digital literacy and innovation among farmers improve their attitudes toward digital agricultural communication. Encouraging achievement motivation, self-confidence, and economic incentives can enhance their positive disposition. Tailoring age-appropriate training and addressing risk concerns should also be considered to further boost attitude levels. The variables age and professional experience was found negatively significant relationship and innovativeness was found positive and significant relationship with the with attitude towards digital agricultural communication and services in the input dealer's sample.R^2 value was found 0.805 in input dealers sample indicating that, the 80.50 per cent variation in the attitude towards digital communication and services was explained by selected independent variable and leaving rest to extraneous. The variables innovativeness and economic motivation was found significantly contributing to attitude levels in regression analysis among input dealers. Based on the results for input dealers, it is recommended to emphasize and nurture innovativeness as a key attribute. Additionally, incentivizing economic motivation can enhance their attitudes toward digital agricultural communication and services. Addressing age-related concerns remains crucial for optimizing their positive disposition towards digital tools and services. The variable innovativeness, achievement motivation and self-confidence were found positive and significant relation with attitude towards digital communication and services. R^2 value was found 0.720 in extension personnel sample indicating that, the 72.00 per cent variation in the attitude towards digital communication and services was explained by selected independent variable and leaving rest to extraneous. The variable IT savvyness, orientation towards digitalization, self-confidence and economic motivation was found significantly contributing to attitude levels was observed in regression analysis.

The variables IT savvyness, orientation towards digitalization, innovativeness, achievement motivation, self-confidence, economic motivation and risk orientation was found positive and significant

Table 3. Relationships and contribution of profile characteristics towards attitude levels of stakeholders (n=270)

S.No	Variable	Farmers (180)		Input dealers (30)		Extension personal (30)		Scientists (30)	
		Spearman rank correlation ρ value	Regression analysis t-value	Spearman rank correlation ρ value	Regression analysis t-value	Spearman rank correlation ρ value	Regression analysis t-value	Spearman rank correlation ρ value	Regression analysis t-value
1	Age	-0.913**	-3.441**	-0.581**	-1.597^{NS}	-0.185^{NS}	0.866^{NS}	-0.003^{NS}	1.682^{NS}
2	Professional experience	-0.736**	0.092^{NS}	-0.449*	-1.136^{NS}	-0.243^{NS}	-1.234^{NS}	0.058^{NS}	-0.270^{NS}
3	Experience in digital gadget usage	-0.092^{NS}	0.651^{NS}	0.279^{NS}	0.385^{NS}	-0.201^{NS}	1.675^{NS}	0.039^{NS}	-0.373^{NS}
4	e-Readiness	0.132^{NS}	0.782^{NS}	0.252^{NS}	1.296^{NS}	-0.001^{NS}	0.218^{NS}	0.327^{NS}	-0.630^{NS}
5	Possession of electronic gadgets	0.072^{NS}	-0.853^{NS}	-0.023^{NS}	-1.164^{NS}	0.135^{NS}	1.467^{NS}	0.046^{NS}	1.260^{NS}
6	IT savvyness	0.732**	-0.153^{NS}	-0.101^{NS}	1.770^{NS}	0.295^{NS}	2.713**	0.937**	0.849^{NS}
7	Orientation towards digitalization	0.890**	-2.130*	-0.072^{NS}	-1.615^{NS}	0.258^{NS}	-2.198*	0.951**	0.535^{NS}
8	Innovativeness	0.699**	2.905**	0.664**	2.966**	0.432*	2.053^{NS}	0.902**	2.841*
9	Achievement motivation	0.244**	-0.266^{NS}	-0.164^{NS}	0.609^{NS}	0.370*	1.454^{NS}	0.872**	-0.789^{NS}
10	Self confidence	0.881**	1.699^{NS}	0.003^{NS}	1.012^{NS}	0.590**	4.895**	0.694**	0.859^{NS}
11	Economic motivation	0.862**	-2.256*	-0.143^{NS}	2.854*	0.322^{NS}	-2.497*	0.890**	-1.628^{NS}
12	Risk orientation	0.874**	1.387^{NS}	-0.149^{NS}	0.666^{NS}	0.322^{NS}	-0.580^{NS}	0.677**	0.465^{NS}
	R square value	R^2 = 0.789		R^2 = 0.805		R^2 = 0.720		R^2 = 0.870	

NS- Non significant * Significant at 5% level ** Significant at 1% level

relationship with attitude towards digital communication and services in scientist sample. R^2 value was found 0.870 in scientist sample indicating that, the 87.00 per cent variation in the attitude towards digital communication and services was explained by selected independent variable and leaving rest to extraneous. The variable Innovativeness was found significantly contributing to attitude levels was observed in regression analysis and results are supported by findings of Chandra et al., (2023).

From the above overall results, it is suggested that develop training programs that cater to different age groups, addressing the negative relationship between age and attitude towards digital agricultural communication. Provide targeted training resources that take into account the preferences and learning styles of various age segments, fostering their confidence and skills in using digital tools effectively. Offer workshops and resources that focus on improving IT savvyness and fostering a digital orientation among stakeholders. These initiatives can help overcome the negative impact of age and professional experience on attitudes, ensuring that participants feel more comfortable and enthusiastic about adopting digital agricultural communication and services. Design campaigns that highlight the positive relationship between innovativeness, achievement motivation, and attitudes. Showcase success stories of farmers who have embraced digital tools to achieve remarkable results in their agricultural practices. Encourage a culture of innovation and celebrate the accomplishments of tech-savvy farmers. Recognizing the positive correlation between self-confidence and attitudes, implement programs that aim to boost the self-confidence of stakeholders in using digital tools. Offer skill-building workshops and mentoring sessions that empower individuals to navigate and leverage digital platforms effectively. Leverage the positive relationship between economic motivation and attitudes by introducing incentive-based programs that highlight the potential economic gains from using digital agricultural communication services. Offer rewards, discounts, or access to exclusive benefits to motivate stakeholders to adopt and engage with digital tools.

CONCLUSION

Digital agricultural communication and services offer the potential to provide real-time insights, expert knowledge, and market trends, empowering farmers and promoting sustainability. As technology and agriculture converge, bridging information gaps, enhancing communication, and refining decision-making processes become paramount. Understanding stakeholders' attitudes towards digital agriculture is vital. Farmers predominantly hold favorable views, with a substantial portion highly positive. Input dealers and extension personnel display positive attitudes, albeit varying. Scientists exhibit the most highly favorable perspectives. To enhance stakeholder attitudes, focus on personalization and responsiveness in digital tools is essential. Tailoring services and ensuring prompt, personalized responses boost satisfaction. Promoting innovation, addressing age-related concerns, and offering targeted training can bridge attitude gaps, fostering enthusiastic adoption of digital technologies. Fostering positive attitudes toward digital agricultural communication is crucial as technology and agriculture harmonize, ushering in an era of informed choices and sustainable practices in Indian agriculture.

REFERENCES

Brennen, J. S., & Kreiss, D. (2016). Digitalization. *The International Encyclopedia of Communication Theory and Philosophy*, pp 1-11.

Chandra, S., Singh, A. K., Ghadei, K., & Pradhan, S. (2023). Exploring the relationship between socio-economic factors and ICT adoption among farmers. *Indian Journal of Extension Education, 59*(3), 54–57.

Dhaka, B. L., & Chayal, K. (2010). Farmers' experience with ICTs on transfer of technology in changing agri-rural environment. *Indian Research Journal of Extension Education, 10*(3), 114-118.

Dutta, A., & Devi, S. M. (2015). E-governance status in India. *International Journal of Computer Sciences and Engineering, 3*(7): 27-31.

Dutta, A., & Jeerh, N. (2023). Digital infrastructure development in India for citizen empowerment. *International Journal of Creative Research Thoughts, 11*(1): 616:620.

Hagberg, J., Sundstrom, M., & Egels-Zandén, N. (2016). The digitalization of retailing: an exploratory framework. *International Journal of Retail & Distribution Management, 44*(7), 694–712.

Mahajan, S. K., Kadam, R. P., & Pawar, G. S. (2022). Correlates between profile of farmers with attitude by using ICT tools in agricultural production. *The Pharma Innovation Journal, 11*(12), 2216-2218.

Morley, J., Widdicks, K., & Hazas, M. (2018). Digitalization, energy and data demand: The impact of Internet traffic on overall and peak electricity consumption. *Energy Research & Social Science, 38*, 128–137.

Nain, M. S., Singh, R., & Mishra, J. R. (2019). Social networking of innovative farmers through WhatsApp messenger for learning exchange: A study of content sharing. *Indian Journal of Agricultural Sciences, 89*(3), 556-558.

Nirmalkar, C., Lahiri, B., Ghsoh, A., Pal, P., Baidya, S., Shil, B., & Kurmi, R.K. (2022). Perceived knowledge and attitude of fisheries extension professionals on usage of ICTs in Tripura. *Indian Journal of Extension Education, 58*(2), 58–64.

Panda, S., Devi, Y. L., Das, L., Mondal, S., Pradhan, K., & Pal, P. K. (2019). Socio-personal determinants of farmers' attitude towards information and communication technology (ICT). *Agricultural Science Digest, 39*(4), 328-331.

Panda, S., Modak, S., Devi, Y. L., Das, L., Pal, P. K., & Nain, M. S. (2019b). Access and usage of information and communication technology (ICT) to accelerate farmers' income. *Journal of Community Mobilization and Sustainable Development, 14*(1), 200-205.

Prasad, C. V., & Pradhan, K. (2019). Assessing the extent of ICT usage by farmers for sustainable agriculture in Sub-Himalayan region. *Indian Research Journal of Extension Education, 19*(4), 15-20.

Rai, A. (2023). Digitalization in agriculture for innovative transformation in India. *Indian Farming, 73*(6), 30–34.

Reddy, K. M. M., Rao, I. S., Srinivasulu, M., & Kumar, G. D. S. (2017). Perception and usefulness of mobile phone based agro-advisories (MBAs). *International Journal of Current Microbiology and Applied Sciences, 6*(7), 866-872.

Sandeep, G. P., Prashanth, P., Sreenivasulu, M., & Madavilata, A. (2022). Effectiveness of agricultural information disseminated through social media. *Indian Journal of Extension Education, 58*(2), 186-190.

Shallu, Sihmar, S., & Meena, K. R. (2019). Digitalization in India: An innovative concept. *International Journal of Engineering Development and Research, 7*(1), 452-456.

Singh, A., Singh, R., Nain, M. S., Mishra, J. R., Kumar, P., Sharma, D. K., & Paul, R. K. (2023). Linkage network structures of farmers: analysing FPOs of M.P. and Bihar in India. *Indian Journal of Extension Education, 59*(3), 14-20. http://doi.org/10.48165/IJEE.2023.59303

Zolkepli, I. A., & Kamarulzaman, Y. (2015). Social media adoption: The role of media needs and innovation characteristics. *Computers in Human Behavior, 43*, 189-209.