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A Scale to Measure the Extent of Social Media Usage for Dissemination of Agricultural Technology by Extension Personnel

Suryawanshi D. B.[1]; O. P. Sharma[2]

[1] Ph. D., Scholar, Department of Agricultural Extension and communication, N. M. College of Agriculture, Navsari Agricultural University, Navsari - 396 450
[2] Professor and Head, Department of Agricultural Extension and communication, N. M. College of Agriculture, Navsari Agricultural University, Navsari - 396 450

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Abstract: A reliable and valid scale has been developed to gauge the extent of social media use for dissemination of agricultural technology by extension personnel. This scale has been crafted utilizing Likert's summated rating technique. The initial phase involved gathering expert input on 91 potential items across nine dimensions, with 76 out of 150 invited experts providing relevancy ratings. Items were selected based on their RP (relevancy percentage), RW (relevancy weightage), as well as MRS(mean relevancy scores), with 61 items progressing to further analysis (RP > 75%, RW > 0.75, MRS > 3.75). These items were then tested on 40 extension personnel, and a t-test was applied to refine the scale. Forty-six statements were ultimately retained due to't' values of 1.75 or greater. The final scale demonstrated strong reliability, evidenced by an 'r' value of 0.869, significant at the one percent level. This robust development process confirms the scale's effectiveness in measuring the extent of use of social media for dissemination of agricultural technology by extension personnel.

Keywords - *Social Media Usage, Extension Personnel, Dissemination of Agricultural Technology, Item Analysis, Reliability and Validity.*

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I. INTRODUCTION

"Social media has become a powerful force in online communication, offering significant potential for connecting and informing the farming community. India's economy depends heavily on its agricultural sector, but struggles with a shortage of extension personnel to effectively reach all farmers. To close this information gap and help India's agriculture sector, using social media platforms like WhatsApp, Facebook, as well as YouTube is very important. These platforms can share valuable information about farming practices, link extension workers with farmers and other experts, and create a learning community where both groups can benefit from shared knowledge and support.

Recently, both extension personnel and farmers in India have widely adopted social media to improve communication and increase their agricultural knowledge. Organizations, including ICAR(Indian Council of Agricultural Research), SAUs(State Agricultural Universities), KVKs(Krishi Vigyan Kendras), and Non-Governmental Organizations (NGOs) have actively created many social media accounts. These platforms are now key channels for both extension personnel and farmers to exchange information and insights on agricultural technologies.

Extension personnel can directly connect with farmers, providing important updates on the latest agricultural technology, best practices, and other relevant information through social media. Farmers use these platforms to ask for advice, raise questions, and share experiences with extension personnel and other farmers, building a collaborative and supportive community. Benefits of social media extend beyond being a cost-effective communication method; they empower social connections along with long-term involvement in extension programs (O'Neill et al., 2011). For farmers, social media could be an excellent way to network alongside build social capital, including engagement, trust, as well as community participation (Stanley, 2013; Mains et al., 2013). Additionally, these tools can help overcome physical distance and isolation in agriculture (Varner, 2012). Increasing usage of social media by extension personnel alongside farmers in India is transforming agricultural communication and knowledge sharing. By using digital platforms, they are working together to improve the agricultural sector, leading to better productivity and overall

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growth. Extension personnel are leveraging these platforms to reach wider audiences, cross geographical barriers, and connect with farmers who don't easily access traditional extension services. Using social media for agricultural technology dissemination can be an effective and efficient way to keep farmers informed and support research efforts.

While several studies have concentrated on how agricultural investigators, along with educators, use social media, there isn't much documentation on how extension personnel specifically use social media for disseminating agricultural technology. There is a clear need to document how it's being used to directly benefit the farming community. In addition to increasing awareness of use of social media platforms for agricultural technology dissemination, but also assesses the current state of social media usage. Understanding usage trends and developing strategies to make social media a core part of agricultural technology dissemination is crucial for determining the full reach of agricultural advisory services. Therefore, this research aimed to create as well as standardize a scale to evaluate extent of social media usage for dissemination of agricultural technology by extension personnel."

II. METHODOLOGY

"The current research was undertaken during the period of 2024-2025. To construct the scale measuring the extent of social media usage, the summated rating scale methodology proposed by Likert (1932) was employed. A comprehensive account of the standardization procedures for this scale, which assesses usage of social media for dissemination of agricultural technology by extension personnel, is provided in the following sections."

➢ *Collection of Items / Statements*

"For the purpose of this study, approximately 110 preliminary statements were generated concerning extent of social media utilization by extension personnel in agricultural technology dissemination. This initial pool was gathered through a comprehensive review of existing literature, academic journals, relevant dissertations, consultations with specialists, and the researchers' experiential knowledge. Adhering to 14 specific criteria established by Thurstone and Chave (1929) and Edwards and Kilpatrick (1948), these statements underwent rigorous editing, resulting in a refined set of 91 statements chosen for further examination."

➢ *Relevancy Weightage Assessment*

Not all collected statements would be equally relevant for measuring extent of social media use by extension personnel in agricultural technology dissemination. Therefore, an expert panel carefully examined these assertions to determine their applicability as well as relevancy for inclusion in final scale.

In this evaluation, 91 refined statements had been sent to a 100-expert panel. These experts were requested to critically assess each statement's relevancy in measuring use of social media for dissemination of agricultural technology by extension personnel. Agricultural scientists from Directorate of Extension, Krishi Vigyan Kendras (KVKs), Subject Matter Specialists, State Agricultural Universities' Agricultural Extension scientists, along with ICAR Research Stations and Institutions, comprised the panel. All selected experts possessed expertise in Information Communication Technology (ICT) alongside social media, and had been actively engaged in field-level extension, making them ideal for critical assessment.

Experts provided their responses on a 5-point Likert-type continuum: MR(Most Relevant), R(Relevant), SWR(Somewhat Relevant), LR(Less Relevant), as well as NR(Not Relevant). Positive statements had been scored 5, 4, 3, 2, as well as 1, respectively; statements that were negative were given inverse ratings of 1, 2, 3, 4, as well as 5.

From the 100 experts contacted, 76 responded within a two-month period. Relevancy score for every item has been determined by summing scores provided by all 76 experts. Subsequently, RP, RW, as well as MRS, were calculated for all 91 items/statements utilizing formulae provided by Edward (1969).

$$Relevancy\ Percentage = \frac{MR\,X_5 + R\,X_4 + SWR\,X_3 + LR\,X_2 + NR\,X_1}{n \times 5} \times 100$$

$$Relevancy\ Weightage\ (RW) = \frac{MR\,X_5 + R\,X_4 + SWR\,X_3 + LR\,X_2 + NR\,X_1}{n \times 5}$$

$$Mean\ Relevancy\ Score = \frac{MR\,X_5 + R\,X_4 + SWR\,X_3 + LR\,X_2 + NR\,X_1}{n}$$

The statements were thoroughly screened for relevancy using three specific criteria. Statements were retained for final selection only if they achieved a relevancy percentage above 75.00%, an RW greater than 0.75, along with a MRS exceeding 3.75.

Through this process, 61 statements from the initial pool of 91 successfully met all three conditions. These statements were then set aside, carefully refined, and rephrased based on the valuable comments provided by the experts. Consequently, these 61 statements (Table 1) had been chosen after comprehensive relevancy evaluation.

➢ *Item Analysis*

61 selected statements underwent item analysis to determine their ability to differentiate between respondents with high versus low social media use for dissemination of agricultural technology. To do this, these statements, which represent the extent of social media usage for dissemination of agricultural technology, have been given to 40 participants from a non-sample region of Gujarat state during 2024-2025.

Respondents had been requested to express how much

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they agree or disagree with every statement on a 5-point continuum: SA (Strongly Agree), A (Agree), UD (Undecided), DA (Disagree), as well as SDA (Strongly Disagree). Five, four, three, two, as well as one were the scores given, accordingly. These scores had been reversed for negative assertions.

After recording all responses, a summated score for total 61 statements has been gained for every participant. Highest possible score has been 305, along with a minimum was 61. These total scores have then been placed in descending order. For item analysis, top 25.00percent of scores (high group) along with bottom 25.00percent of scores (low group) were selected.

Critical ratio or t-value has been computed for every statement employing formula provided by Edwards (1969). This value served as an indicator of how effectively a particular statement differentiated among high as well as low groups of participants, guiding selection of items for final scale.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \qquad S_p = \sqrt{\frac{(n_1 - 1){S_1}^2 + (n_2 - 1){S_2}^2}{n_1 + n_2 - 2}}$$

Here,

t = t – statistic

S_p = Standard deviation

$\bar{x}_1$ = Observed mean of high group

$\bar{x}_2$ = Observed mean of low group

S_1 = Standard deviation of high group

S_2 = Standard deviation of low group

n_1 = Sample size of high group

n_2 = Sample size of low group

After computing t-values for all statements on the attitude scale, these values have been placed in descending order. From this ordered list, 46 statements have been selected for final scale; these were statements having highest t-values, specifically those equal to or greater than 1.75, applicable to both positive as well as negative statements.

➢ *Final Scale Item Selection For Social Media Usage*

Upon computing the t-values for each item, 46 statements exhibiting the highest t-values (specifically, ≥1.75) were selected. This decision was guided by the established "thumb rule" for discarding items with t-values below 1.75, as outlined by Edwards A. L. (1957).

This principle dictates the inclusion of items with strong discriminatory capabilities while excluding those with weak discriminatory power or dubious validity. Therefore, 46 statements had been ultimately retained for consideration in final scale, contingent upon meeting these norms: The t-value must be ≥1.75, the statement must introduce a novel concept, ensuring no redundancy with ideas expressed elsewhere, and statement should be phrased simply as well as succinctly.

➢ *Reliability And Validity Of The Perception And Acceptance Scale*

Developed scale underwent further standardization through the establishment of its reliability and validity. Reliability, defined by Ganeshkumar and Ratnakar (2011) as "the accuracy or precision of measuring instrument," was assessed using test-retest method on the social media usage scale. Validity, which means truthfulness, referred to "the degree to which a test measures what it claims to measure" (Kerlinger, 1976). To measure this scale's validity, content validity has been employed.

➢ *Split-Half Methodology*

Social Media reliability usage scale has been assessed using the test-retest approach. Developed scale has been first given to thirty extension personnel who had not been previously contacted or included in the final sample. After 15 days, the same 30 individuals completed the scale again, yielding two sets of scores. Each of these 2 sets of statements has been treated as a separate subscale, alongside the correlation between them was then calculated. Coefficient of reliability, computed using Rulon's formula (Guilford, 1954), has been seen to be 0.8697. This high coefficient indicates that the developed scale is highly reliable. Reliability coefficient of entire test has been subsequently computed utilizing Rulon's formula provided below.

➢ *Rulon's Formula*

$$\boldsymbol{rtt = 1 - \frac{\sigma d^2}{\sigma t^2}}$$

Where;

$$\boldsymbol{\sigma d^2 = \frac{\sum d^2 - \frac{(\sum d)^2}{30}}{30}}$$

$$\boldsymbol{\sigma t^2 = \frac{\sum t^2 - \frac{(\sum t)^2}{30}}{30}}$$

Where;

$\boldsymbol{rtt}$ - Reliability coefficient

$\boldsymbol{\sigma d^2}$ - Variance of difference

$\boldsymbol{\sigma t^2}$ - Variance of total score

➢ *Content Validity Of The Extent Of Social Media Usage Scale*

Scale's validity has been established through content validity, which assesses how representative instrument's

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content is. This scale meets these criteria because its "universe of statements" regarding ICT-enabled farm advisory services was developed from established standards, alongside consultation with experts knowledgeable about psychological constructs. This process confirms high content validity for the perception as well as acceptance scale.

Scale's construction followed the steps outlined for a summated scale of ratings by Edward A. L. (1957). Hence, it is reasonable to assume that scores obtained from this scale accurately determine how ICT-enabled farm advising services are perceived as well as accepted. During selection of perception statements, careful attention was paid to achieving a high level of content validity. Fact that computed t-value has been significant for every completed statement further indicates their strong discriminating power, reinforcing the scale's validity as a gauge of perception.

- *Administering And Scoring The Social Media Usage Scale*

Final scale comprises 46 statements (Table 1). Respondents indicate their agreement on a 5-point continuum: SA, A, UN, D, as well as SD. These responses receive scores of 5, 4, 3, 2, as well as 1, respectively, for positive statements. When a statement is negative, score is reversed. This scale has a minimum score of 46 along with a maximum score of 230. A higher score indicated that extension personnel used social media more extensively to spread agricultural technologies, while a lower score suggested less effective or poorer social media usage for this purpose.

III. CONCLUSION

In conclusion, the developed scale for measuring the extent of social media use for dissemination of agricultural technology by extension personnel has proven to be both reliable and valid. When administered to 40 extension personnel in a non-sample region, the scale presented no difficulties in its application. Therefore, it can be confidently stated that this scale effectively and explicitly measures social media usage by extension personnel for agricultural technology dissemination. Researchers can readily utilize this validated scale in future similar studies.

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Table 1 Scale on Extent of Social Media Usage by Extension Personnel for Dissemination of Agricultural Technology Relevancy Percentage (RP), Relevancy Weightage (RW), Mean Relevancy Scores (MRS) and 'T' Values

Sr. No.	Indicators wise Statements	RP	RW	MRS	't' value
A	**Time Management for Social Media Activities**				
1	I allocate a specific amount of time each day/week for social media activities related to extension	**81.1**	**0.81**	**4.05**	3.13
2	I have strategies to avoid social media burnout	**74.2**	**0.74**	**3.71**	3.10
3	I find it easy to balance social media use with my other extension responsibilities	**84.5**	**0.85**	**4.22**	3.66
4	I use tools or apps to manage my time effectively on social media	**82.4**	**0.82**	**4.12**	1.52
5	I prioritize responding to farmers' queries and engaging in discussions on social media	**87.9**	**0.88**	**4.39**	4.16
6	I sometimes get distracted by social media and loose track of my other tasks	74.2	0.74	3.71	NS
7	I don't always stick to the time allocated for social media activities related extension work	**77.1**	**0.77**	**3.86**	1.66
8	I find it hard to disconnect from social media, even outside of work hours	68.7	0.69	3.43	NS
9	I struggle to find enough time for social media activities	70.5	0.71	3.53	NS

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10	I sometimes feel overwhelmed by the amount of information and interaction on social media	**76.8**	**0.77**	**3.84**	3.58
B	**Content Variety and Type**				
1	I share practical tips and advice that farmers can implement directly	**87.9**	**0.88**	**4.39**	4.71
2	I provide updates on the latest agricultural news and research findings	**86.6**	**0.87**	**4.33**	4.20
3	I curate and share relevant content from other reliable sources	**83.7**	**0.84**	**4.18**	5.53
4	I use storytelling techniques to make my social media content more engaging	**82.4**	**0.82**	**4.12**	5.06
5	I tailor my content to the specific interests and needs of farmers in my region	**83.7**	**0.84**	**4.18**	0.80
6	Sometimes the information I share on social media is too general or not relevant to my local farmers	66.6	0.67	3.33	NS
7	I have difficulty in verifying the accuracy of all the agricultural information I found online	**75.8**	**0.76**	**3.79**	3.60
8	My social media content may be repetitive or uninspiring	63.7	0.64	3.18	NS
9	I mostly share factual information without incorporating enough humor or personal elements	69.7	0.7	3.49	NS
10	I struggle to come up with new and creative content ideas on a regular basis	**76.3**	**0.76**	**3.82**	1.41
C	**Social Media Posting Frequency**				
1	I post on social media multiple times a day for extension purposes	**76.1**	**0.76**	**3.8**	4.58
2	I maintain a consistent posting schedule on social media	**79.5**	**0.8**	**3.97**	6.64
3	I post frequently enough to stay visible and engaged with my audience	**80.3**	**0.8**	**4.01**	6.64
4	I am strategic about the best times to post on social media for maximum reach	**82.4**	**0.82**	**4.12**	1.71
5	I increase my posting frequency around important events or when sharing time-sensitive information	**80.3**	**0.8**	**4.01**	7.20
6	I sometimes go several days or weeks without posting on social media	**75.5**	**0.76**	**3.78**	3.79
7	I find it difficult to keep up with a regular posting schedule	**76.1**	**0.76**	**3.8**	1.62
8	I worry that I might be posting too often and overwhelming my audience	67.6	0.68	3.38	NS
9	I rarely post updates outside of my regular working hours	70.3	0.7	3.51	NS
10	I struggle to find enough relevant content to post consistently	70	0.7	3.5	NS
D	**Professional Collaboration and Networking**				
1	I use social media to connect with other extension professionals	**86.3**	**0.86**	**4.32**	2.94
2	I participate in social media groups or communities focused on agricultural extension	**86.6**	**0.87**	**4.33**	1.34
3	I collaborate with other organizations or experts on social media campaigns related to agriculture	**84.7**	**0.85**	**4.24**	4.09
4	I use social media to learn from experienced farmers and share their knowledge	**86.1**	**0.86**	**4.3**	3.35
5	I actively seek out new connections and partnerships through social media	**81.8**	**0.82**	**4.09**	1.24
6	I mainly use social media to broadcast information and don't interact much with others	**76.1**	**0.76**	3.8	2.88
7	I am hesitant to reach out online to other extension professionals or organizations	69	0.69	3.45	NS
8	I don't have many connections on social media that are relevant to my extension work	70.3	0.7	3.51	NS
9	I struggle to keep up with the conversations and discussions happening in online groups	**76.1**	**0.76**	3.8	3.09
10	I find that online interactions lack the depth and personal touch of in-person networking	70.5	0.71	3.53	NS
E	**Audience Engagement**				
1	I regularly respond to comments and questions on my social media posts	**82.9**	**0.83**	**4.14**	4.57
2	I use interactive features like polls, quizzes, or question & answering sessions to keep my audience engaged	**81.1**	**0.81**	**4.05**	1.63
3	I encourage farmers to share their experiences and knowledge on social media	**84**	**0.84**	**4.2**	4.99

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4	I make an effort to personalize my interactions with my followers	**80**	**0.8**	**4**	5.53
5	I track my audience engagement metrics (likes, shares, comments) to assess my effectiveness	**79**	**0.79**	**3.95**	5.67
6	I host live events or webinars on social media	74.5	0.75	**3.72**	NS
7	I create contests or challenges to encourage participation	**80.3**	**0.8**	**4.01**	1.05
8	I sometimes find it difficult to keep up with all the comments and messages on my social media posts	**76.3**	**0.76**	**3.82**	5.02
9	I am not sure how to create content that is truly engaging for my audience	70	0.7	3.5	NS
10	I find that my audience interaction is mostly one-sided with farmers consuming information rather than actively participating	67.4	0.67	3.37	NS
11	I sometimes receive negative or critical comments on social media that are difficult to handle	68.2	0.68	3.41	NS
12	I don't always have the time to foster meaningful conversations on social media	71.8	0.72	3.59	NS
F	**Perceived Effectiveness**				
1	I believe social media helps me in reaching a wider range of farming community	**86.8**	**0.87**	**4.34**	3.58
2	I believe social media has improved my overall effectiveness as an extension worker	**85.8**	**0.86**	**4.29**	4.00
3	I have seen increased adoption of new agricultural practices as a result of my social media use	**84.5**	**0.85**	**4.22**	5.43
4	I receive positive feedback from farmers about my social media content	**84**	**0.84**	**4.2**	4.37
5	I feel that social media has helped me in building effective two-way bridge with farmers in my region	**83.2**	**0.83**	**4.16**	4.2
6	I sometimes question whether my social media efforts are actually making a real difference	72.9	0.73	3.64	NS
7	I find it hard to observe the impact of my social media activities on farmers' awareness and knowledge	**76.3**	**0.76**	**3.82**	1.7
8	I am not sure that I am effectively reaching the farmers who need the information the most	71.6	0.72	3.58	NS
9	I feel I could use social media more strategically for greater impact	**75.5**	**0.76**	**3.78**	1.63
G	**Feedback and Evaluation**				
1	I regularly monitor and analyze my social media metrics to track my performance	**82.6**	**0.83**	**4.13**	4.09
2	I actively seek feedback from farmers about my social media content and activities	**82.9**	**0.83**	**4.14**	7.83
3	I use surveys or polls to gather input on how I can improve my social media content	**79.5**	**0.8**	**3.97**	6.11
4	I adapt my social media strategies based on the feedback and evaluation data I collect	**80**	**0.8**	**4**	4.57
5	I set clear goals and objectives for my social media use in agricultural extension	**81.1**	**0.81**	**4.05**	3.81
6	I have a system for documenting and tracking the results of my social media activities	**75.5**	**0.76**	**3.78**	5.03
7	I don't consistently track my social media analytics or measure my results	73.4	0.73	3.67	NS
8	I mainly rely on my own intuition to judge the effectiveness of my social media work	71.1	0.71	3.55	NS
9	I find it difficult to obtain meaningful feedback from farmers about my social media	**75.8**	**0.76**	**3.79**	1.64
10	I sometimes feel defensive about feedback and struggle to make changes based on it	66.6	0.67	3.33	NS
11	I don't have a clear plan for evaluating the long-term impact of my social media use	69	0.69	3.45	NS
H	**Training and Capacity Building**				
1	I actively seek out training and professional development opportunities to improve my social media skills	**86.6**	**0.87**	**4.33**	4.38
2	I regularly attend workshops or webinars focused on social media for agricultural extension	**85**	**0.85**	**4.25**	4.16

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3	I am part of a community or network where I can learn from other extension professionals using social media	**84.7**	**0.85**	**4.24**	2.98
4	I provide training to other extension workers on best practices for using social media in extension activities	**80.5**	**0.81**	**4.03**	6.09
5	My organization provides resources and support for social media skill development	**80**	**0.8**	**4**	4.02
6	I haven't received any formal training on the use of social media for extension work	71.1	0.71	3.55	NS
7	I don't have the time or resources to focus on professional development of extension personnel or farmers in this area	**75.5**	**0.76**	**3.78**	0.9
8	I find it hard to follow up with the latest social media trends and best practices	**76.3**	**0.76**	**3.82**	1.63
9	I feel unsupported and alone in my social media efforts, without much guidance	69.7	0.7	3.49	NS
10	My organization does not prioritize training on social media for extension workers	69.5	0.7	3.47	NS
I	**Identifying Barriers and Challenges**				
1	I am aware of the common challenges associated with using social media for agricultural extension	**86.1**	**0.86**	**4.3**	4.44
2	I have solutions to overcome any barriers to using social media effectively	**80**	**0.8**	**4**	1.52
3	I can troubleshoot common technical difficulties I might encounter with social media	**79.2**	**0.79**	**3.96**	5.96
4	I am aware of the potential risk associated with social media use and actively take measures to safeguard myself and others	**82.4**	**0.82**	**4.12**	3.58
5	I often feel unable to handle the challenges and demands of using social media for extension work	**77.4**	**0.77**	**3.87**	1.66
6	Limited access to reliable internet and technology restricts my ability to use social media effectively	71.6	0.72	3.58	NS
7	Farmers in my area have limited access to social media platforms or smartphones	74	0.74	3.7	NS
8	I find it difficult to create social media content in local language	**75**	**0.75**	**3.75**	6.52
9	I am worried about the spread of inaccurate agricultural information on social media	**77.6**	**0.78**	**3.88**	3.07