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Measuring Stakeholder Attitudes towards Digital Agricultural Communication and Services : Development of a Comprehensive Attitude Scale

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Abstract

Digitalization is transforming agriculture through improved communication and services. Agricultural extension departments are key players in providing real-time information to farmers, optimizing resource utilization and fostering innovation. By embracing digitalization responsibly, the agriculture sector can unlock its full potential for increased productivity and sustainability. Keeping this in view, a standardized scale had been developed to measure the attitude of stakeholders towards digital agricultural communication and services. Method of summated rating scale by Likert (1932) was used. An attempt is made in current investigation to develop a standardized scale to analyze the attitude of stakeholders in agriculture towards digital agricultural communication and services. The process started with identifying the dimension, collection of items followed by relevancy and item analysis, checking the reliability and validity for precision and consistency of the results. The developed scale was found reliable and valid. The scale measuring the attitude of stakeholders towards digital agricultural communication and services consists of 48 statements, classified under six dimensions.

Keywords : Attitude, Digital communication and services, Likert's, Multidimensional scale, Digitalisation

Digitalization of agricultural communication and services have emerged as a crucial aspect in revolutionizing India's agriculture sector. Digitalization refers to the restructuring of various aspects of social life through the utilization of digital communication and media systems. Put simply, it involves the application of digital technologies to transform how different areas of society function (Srai and Lorentz, 2019). The ongoing process of digitalization stands as a paramount transformation within modern society, encompassing various facets of both business and daily existence (Hagberg *et al.,* 2016). With a vast population heavily reliant on farming for livelihood, the integration of digital technologies has ushered in a transformative era, providing farmers with timely information and improved services. One of the most significant advantages of digital communication and services in Indian agriculture is the facilitation of real-time access to critical information for farmers. Digitalization enables the manipulation of information, encompassing text, graphics, software code, audio and video, in innovative ways that were previously unimaginable and this underscores its capacity to inform and effect transformative changes (Maxwell and McCain, 1997). This availability of timely information empowers farmers to make informed decisions, plan agricultural activities effectively and mitigate risks associated with weather fluctuations and market uncertainty. Digitalization has also enabled precision agriculture in India, contributing to resource optimization and sustainable practices. This precision-driven approach helps conserve water, reduce chemical usage and improve overall agricultural efficiency,

thereby promoting sustainable farming practices. Moreover, digital agricultural communication has democratized agricultural knowledge, transcending geographical barriers. The widespread adoption of smartphones and internet connectivity in rural areas has empowered even remote farmers with valuable information. Farmers can access and exchange knowledge, experiences and innovations with their peers across regions, promoting learning and sharing of best practices. In this particular scenario, examining the attitude of various stakeholders concerning digital agricultural communication and services holds significant importance, given its direct impact on the adoption and optimal utilization of these services. 'Attitude' can be defined as the level of positive or negative emotions linked to a particular psychological entity. This entity could encompass symbols, phrases, slogans, individuals, institutions or ideas, around which individuals can hold varying degrees of positive or negative sentiments. The primary aim of the research was to create a metric for gauging stakeholders' attitudes towards digital agricultural communication and services. According to this study, the operational definition of attitude was refined to encompass the extent of favorable or unfavorable emotions expressed by respondents in relation to the usability, responsiveness, quality, personalization, system availability and efficiency, as well as their satisfaction with digital agricultural communication and services.

METHODOLOGY

The study was conducted between 2022 and 2023 with the core objective of establishment of a uniform scale for evaluating stakeholders' sentiments regarding digital agricultural communication and services. This initiative sought to enhance the integration of digitalization within the agricultural domain. The comprehensive process of formulating the attitude scale is elucidated in the subsequent subsections.

Selection of type of attitude scale : To develop the scale for measuring stakeholders' attitudes, the method of summated rating scale, as suggested by Likert (1932), was utilized. This approach was selected as it is widely recognized and appropriate for assessing attitudes related to digital agricultural communication and services. The subsequent steps outline the process of constructing the attitude scale.

Identification of dimensions : Six major dimensions related to digital agricultural communication and services in agriculture were identified based on review of literature and discussion with the experts with Agricultural Extension and allied sciences. The dimensions identified were Usability, Responsiveness, Quality, Personalization, System availability and efficiency and satisfaction. Both positive as well as negative statements pertaining to the psychological object were included.

Collection and editing of items: The items on attitude of stakeholders on digital agricultural communications and services were collected exhaustively. A tentative list of 90 items pertaining to the attitude of the stakeholders was collected. The items developed were edited as per the 14 criteria enunciated by Edwards (1969) and Thurstone and Chave (1929).

Relevancy test : The scale containing attitude assessment items was administered to 80 evaluators using Google Forms and distributed in person within the fields of Agricultural Extension and Economics. The evaluators were tasked with critically appraising the pertinence of each item on a five-point continuum: Most Relevant (MR), Relevant (R), Somewhat Relevant (SWR), Less Relevant (LR) and Not Relevant (NR). Corresponding scores of 5, 4, 3, 2, and 1 were allocated to the responses, respectively. Additionally, the evaluators were invited to suggest modifications, additions or removals of statements as they saw fit. Out of the received questionnaires, 60 that were fully completed were included for subsequent analysis. Utilizing the amassed data, metrics such as 'Relevancy Percentage', 'Relevancy Weightage' and 'Mean Relevancy Score' were computed. These metrics were then applied to evaluate the appropriateness of individual statements. This evaluation process was executed by means of the following formulas.

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$$\text{Relevancy Weightage of } i^{th} \text{ factor (RWi)} = \frac{(MR\times5)+(R\times4)+(SWR \times 3) + (LR\times2) + (NR\times1)}{\text{(Maximum possible score)}}$$

$$\text{Relevancy Percentage of } i^{th} \text{ factor } (RP_i) = \frac{(MR\times5)+(R\times4)+(SWR\times3) + (LR\times2)+(NR\times1)}{\text{Maximum possible score}} \times 100$$

$$\text{Mean Relevancy Score of } i^{th} \text{ factor } (MRS_i) = \frac{(MR\times5)+(R\times4)+(SMR\times3) +(LR\times2)+(NR\times1)}{\text{Number of judges responded}}$$

Based on these calculated values, individual items underwent a screening process. Items meeting the criteria of a relevancy weightage exceeding 0.75, a relevancy percentage surpassing 75 per cent and a mean relevancy score equal to or higher than 3.75 were selected for further analysis.

Item analysis : To conduct item analysis, a cohort of 40 participants (consisting of 28 farmers, 4 input dealers, 4 extension professionals and 4 scientists) was carefully chosen from the Central Telangana Zone. Each participant was directed to express their response for each item according to their respective scoring scheme. Responses were collected along a five-point continuum: Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. Positive statements received scores of 5, 4, 3, 2 and 1, while negative statements were scored in reverse order. Based on the cumulative scores, the respondents' rankings were established in descending order. The upper 25 per cent of participants with the highest total scores constituted the high-performing group, while the lower 25 per cent formed the low-performing group, similar approach was adopted by Shireesha *et al.* (2016) and Sowjanya and Gangadharappa (2017). These two groups served as reference points for evaluating the individual statements, as proposed by Edwards (1969). For each statement, a 't' value was calculated using the subsequent formula:

$$t = \frac{\overline{X}_H - \overline{X}_L}{\sqrt{\frac{\sum X_H^2 - \frac{(\sum X_H)^2}{n} \times \sum X_L^2 - \frac{(\sum X_L)^2}{n}}{n(n-1)}}}$$

Where,

$\overline{X}_H$= The mean score on given statement of the high group, $\overline{X}_L$ = The mean score on given statement of the low group, $\sum X^2_H$= Sum of squares of the individual score on a given statement for high group, $\sum X^2_L$ = Sum of squares of the individual score on a given statement for low group, n = Number of respondents in each group, $\sum$ = Summation, t = The extent to which a given statement differentiates between the high and low groups.

Standardization of the scale: Scale was standardized by applying reliability and validity test.

Reliability of the Scale :

a) Half test reliability formula :

$$r_{11} = \frac{N\,(\sum XY) - (\sum X)}{\sqrt{N\,(\sum XY - (\sum X)^2\,(N\,(\sum XY^2 - (\sum Y)^2}}$$

Where, $\sum X$= Sum of the scores of the odd number items, $\sum Y$ = Sum of the scores of the even number items, $\sum X^2$= Sum of the squares of the odd number items, $\sum Y^2$ = Sum of the squares of the even number items

b) Whole test reliability formula

$$r_{11} = \frac{2\times r1/2}{1+r1/2}$$

Where, $r_{1/2}$ = Half test reliability

The split-half method was employed to test the reliability of the scale. The value of correlation coefficient for scale to measure was observed and this further corrected by using Spearman Brown formula to obtain the reliability coefficient of the whole set.

Validity: It refers to how well a scale measures what it is supposed to measure. The validity of the scale was tested by content and statistical validity methods. The data was subjected to statistical validity.

$$\text{Validity formula} = \sqrt{r_{11}}$$

Results and Discussion

From Table 1, it was observed that 78 items were retained after the editing of items. 68 items fullfilled the criteria of relevancy percentage more than 75 per cent and mean relevancy score 3.75 out of 78 statements. Sixty-eight items were administered to sample of forty stakeholders. Three items from usability dimensions, two items from responsiveness, one item from quality, two items from personalization, one item from system availability and one item from satisfaction dimension was eliminated as it doesn't fulfilled criteria of relevancy.

Table 1
Summary of items in scale construction steps

Steps	Attitude towards DACS	
	Statement considered	Statement retained
Collection of items	90	90
Editing of items	90	78
Relevancy analysis	78	68
Item analysis	68	48
Standardisation of scale	48	48
Administration of scale	48	48

From Table 2, it can be observed that a total of 48 items fulfilled the criteria of t -value greater than 1.75 that observed among top and bottom groups among 40 sample. Six items from usability, one item from responsiveness, four items from quality, one item from personalization, six items from system availability and efficiency and two items from satisfaction were eliminated. The remaining forty-eight items were administered to reliability and validity test.

The split-half method was utilized to assess the scale's reliability. As indicated in Table 3, the correlation coefficient value for measuring attitude was recorded at 0.765. This value was subsequently adjusted through the employment of the Spearman-Brown formula to derive the overall reliability coefficient for the complete set. The resultant 'r' value for the scale reached 0.867, signifying high reliability. This outcome led to the conclusion that the constructed scale demonstrated reliable performance. The collected data was subjected to statistical validity analysis, yielding a value of 0.931 for the attitude measurement scale concerning stakeholders. This value exceeded the established benchmark of 0.70, confirming the validity of the coefficient and affirming its appropriateness for the developed tool.

Table 2
Itemwise calculated t values between higher and lower groups

Statements/ Items	Total Score (n=60)	R.P % (n=60)	M.R.S (n=60)	t-value (n=20)
I. *Usability*				
Finding or identifying the required services and information digitally is easy for me	271	90.33	4.52	1.964 *
Digital services and communication are consistent and standardized	240	80.00	4.00	5.267 *
The digital services and communication platforms are easy to operate	253	84.33	4.22	0.688 NS
My interaction with digital services and communication platforms is clear and understandable	260	86.67	4.33	4.129 *
Digital services and communication platforms have attractive appearance	241	80.33	4.02	2.250 *
Digital services and communication provide positive experiences	246	82.00	4.10	2.333 *
It is easy to get any services and information through digitally	244	81.33	4.07	1.044 NS
Digital technology for services and communication makes people spend equal or more time than traditional methods	229	76.33	3.82	1.007 NS

Table 2 Conti....

Statements/ Items	Total Score (n=60)	R.P % (n=60)	M.R.S (n=60)	t-value (n=20)
I feel it's necessary to use frequently digital platforms for agricultural services and communication	258	86.00	4.30	2.466 *
Digital agricultural services and communication are as productive as traditional method	249	83.00	4.15	0.747 NS
The digital services and communication platforms have a great visual appeal	245	81.67	4.08	1.116 NS
The user interface of digital services and communication are well organized	256	85.33	4.27	0.933 NS
The digital services and communications are designed innovatively for its use	250	83.33	4.17	1.890 *
Use of hard copies of details regarding the information received and services through digital platforms is essential and adds workload (-)	237	79.00	3.95	2.191 *
Digital services are on par with the traditional services with human touch	246	82.00	4.10	5.128 *
II. *Responsiveness*				
Digital platforms have easy step by step process to avail services and communication	262	87.33	4.37	4.837 *
Digital services and communication save time in accessing information	270	90.00	4.50	1.387 NS
Digital platforms enable me to be get better agricultural services and information	277	92.33	4.62	2.835 *
I believe the digital agricultural services and communication gives time to planned prompt services and information's to stakeholders	261	87.00	4.35	4.230 *
I believe the digital services and communication don't miss responding to stakeholders' requirements	241	80.33	4.02	4.076 *
Digital services and communication always show a sincere interest when stakeholders have problem	232	77.33	3.87	3.579 *
The digital services and communication provided are relevant and accurate	249	83.00	4.15	3.207 *
Unlike traditional patterns, the digital communication and services are never too busy to responding to stake holders requirement	258	86.00	4.30	2.929 *
III. *Quality*				
Digital services and communication keeps their promise in delivering their undertakings to do certain things by certain time	267	89.00	4.45	2.586*
The services and communication done through digital platforms are error free and highly reachable	251	83.67	4.18	2.762 *
Digital services are available at all the times and provides the same service	255	85.00	4.25	4.837 *
Information and services available through digital platforms are at the right level of detailing without the need of any other human intervention	243	81.00	4.05	1.236 NS
Communication and services are made available on digital platforms through appropriate formats	268	89.33	4.47	1.053 NS
The agricultural services and communication through digital platforms are in accordance with seasonality	231	77.00	3.85	2.121 *
The services and communication on digital platforms are pretty suitable for me to carry out the tasks	252	84.00	4.20	1.890 *
Digital services and communication instils confidence among its users on the cosmopolite channel to fully utilizes the department services	254	84.67	4.23	1.924 *
Digital services and communications are consistently courteous with users	255	85.00	4.25	1.387 NS

Table 2 Conti....

Statements/ Items	Total Score (n=60)	R.P % (n=60)	M.R.S (n=60)	t-value (n=20)
I feel I can trust the digital services and communication in meeting all technical support for agriculture and farming	255	85.00	4.25	3.464 *
The agricultural information and services received are often of times wrongly delivered and leading to users dissatisfaction	259	86.33	4.32	1.799 *
The agricultural information and services received are often of times wrongly delivered and leading to users dissatisfaction (-)	238	79.33	3.97	0.771 NS
IV. *Personalization*				
My personal details given for digital services and communication are protected and in safe hands	267	89.00	4.45	3.810 *
Digital service and communication platforms have adequate security for its use	248	82.67	4.13	2.449 *
My personal information given for the agricultural services and communications are liable to be shared with others without intimation (-)	249	83.00	4.15	2.862 *
Digital communication and services are capable of delivering customized solutions for users need	263	87.67	4.38	0.664 NS
The digital agricultural communication and services gives personalized attention for every users	235	78.33	3.92	1.922 *
The digital platforms provide to get services and information in a way that meets users personal needs	242	80.67	4.03	4.230 *
Digital platforms in agriculture understand my needs and provides appropriate services and information to achieve them	237	79.00	3.95	4.005 *
It feels safe to complete monetary transactions in digital platforms for agricultural services and communication	250	83.33	4.17	1.985 *
V. *System availability and efficiency*				
Digital services and communications are always available for access	276	92.00	4.60	1.406 NS
The digital services and communication platforms are safe from physical and logical destruction	252	84.00	4.20	3.030 *
Due to maintenance requirements frequently digital services and communication are subjected to "out of access" for its users (-)	238	79.33	3.97	1.232 NS
To get correct response from digital services and communication, one should have ample of patience in using (-)	244	81.33	4.07	2.433 *
The digital services and communication and traditional systems complement each other well in serving stakeholders needs	247	82.33	4.12	2.121 *
It is possible to get additional information and services with digital platforms	254	84.67	4.23	1.324 NS
Digital services and communication enables me to complete my process quickly	269	89.67	4.48	1.500 NS
The digital services and communication are available in multiple platforms	266	88.67	4.43	5.367 *
The digital services and communication records are traceable even after the crop season	262	87.33	4.37	3.498 *
The digital services and communication are useful in day to day farming activities	268	89.33	4.47	4.371 *
Digital communication and services in agriculture are discussed to respond even in critical times	248	82.67	4.13	0.758 NS
Digital communication and services delivers what we intend	256	85.33	4.27	1.265 NS

Table 2 Conti....

Statements/ Items	Total Score (n=60)	R.P % (n=60)	M.R.S (n=60)	t-value (n=20)
Digitalization of agricultural services and communications are truthful and 24 X 7 about its offering	259	86.33	4.32	4.333 *
Digitalization agricultural services and communications makes clear about what they are for	250	83.33	4.17	2.324 *
Digital services and communication needs users to acquires extra technical knowledge to use them	260	86.67	4.33	4.439 *
VI. *Satisfaction*				
Stakeholders in agriculture are happy with communication and services provided through digital platforms	257	85.67	4.28	2.090 *
It is difficult to support the provision of information and services through digital platforms without personal human touch	237	79.00	3.95	4.439 *
In general, users are pleased with overall digital services and communication in agriculture	251	83.67	4.18	4.230 *
Users are satisfied with transparency and clarity of digital services and communication	249	83.00	4.15	5.301 *
Error free digital system services and communication makes users to feel more satisfied	251	83.67	4.18	0.688 NS
Stakeholders would like to use digital communication and service	244	81.33	4.07	1.265 NS
Users are choosing digital platforms and communication frequently and continuously as and when possible	264	88.00	4.40	3.795 *
Digital inclusion in agriculture helps to eliminate the duplication and identifying the true beneficiaries	262	87.33	4.37	2.178 *
Once the stakeholders in agriculture starts using digital services and communication, they will uses them in future too	260	86.67	4.33	1.821 *
I personally recommend my peers to use the digital services and communication f or agriculture needs	272	90.67	4.53	2.568 *

(-) Negative statement NS- Non significant * selected for final administration of scale

TABLE 3

Summary of reliability analysis of 48 items

(n = 40)

Cronbach's Alpha	Part1	Value	0.878
		N of items	24
	Part 2	Value	0.887
		N of items	24
Correlation between forms		0.765	
Spear man- Brown Coefficient		Equal length	0.867
		Unequal Length	0.867
Statistical validity		0.931	

From Table 4 and Fig. 1, it can be observed that nearly half (45.00 per cent) of the respondents were belongs to favorable levels of attitude in usability dimension, followed by equal (27.50 per cent) frequency in most favourable and least favorable level. Favourable levels (42.50 per cent) emerged as high frequency group in responsiveness dimension, followed by least favorable levels (35.00 per cent) and most favourable levels (22.50 per cent). Interestingly, most favorable levels (40.00 per cent) emerged as high frequency group, followed by least favorable levels (37.50 per cent) and favourable levels (22.50 per cent) in quality dimension.

TABLE 4

Dimension wise distribution of stakeholders towards digital agricultural communication and services

Characteristics	Category	Stakeholders (40)		Mean score	Rank
		f	%		
Usability	Least favourable (< Mean - ½ SD)	11	27.50		
(Mean 32.68 ½ S.D 1.89)	Favourable (Mean ± ½ SD)	18	45.00	3.63	III
	Most favourable (>Mean ± ½ SD)	11	27.50		
Responsiveness	Least favourable (< Mean - ½ SD)	14	35.00		
(Mean 24.43 ½ S.D. 1.82)	Favourable (Mean ± ½ SD)	17	42.50	3.49	VI
	Most favourable (>Mean ± ½ SD)	09	22.50		
Quality	Least favourable (< Mean - ½ SD)	15	37.50		
(Mean 28.23½ S.D. 2.21)	Favourable (Mean ± ½ SD)	09	22.50	3.71	II
	Most favourable (>Mean ± ½ SD)	16	40.00		
Personalization	Least favourable (< Mean - ½ SD)	13	32.50		
(Mean 24.93 ½ S.D. 1.76)	Favourable (Mean ± ½ SD)	16	40.00	3.56	IV
	Most favourable (>Mean ± ½ SD)	11	27.50		
System availability and efficiency	Least favourable (< Mean - ½ SD)	16	40.00		
(Mean 33.40 ½ S.D. 2.31)	Favourable (Mean ± ½ SD)	13	32.50	3.53	V
	Most favourable (>Mean ± ½ SD)	11	27.50		
Satisfaction	Least favourable (< Mean - ½ SD)	09	22.50		
(Mean 30.93 ½ S.D 2.344)	Favourable (Mean ± ½ SD)	16	40.00	3.87	I
	Most favourable (>Mean ± ½ SD)	15	37.50		

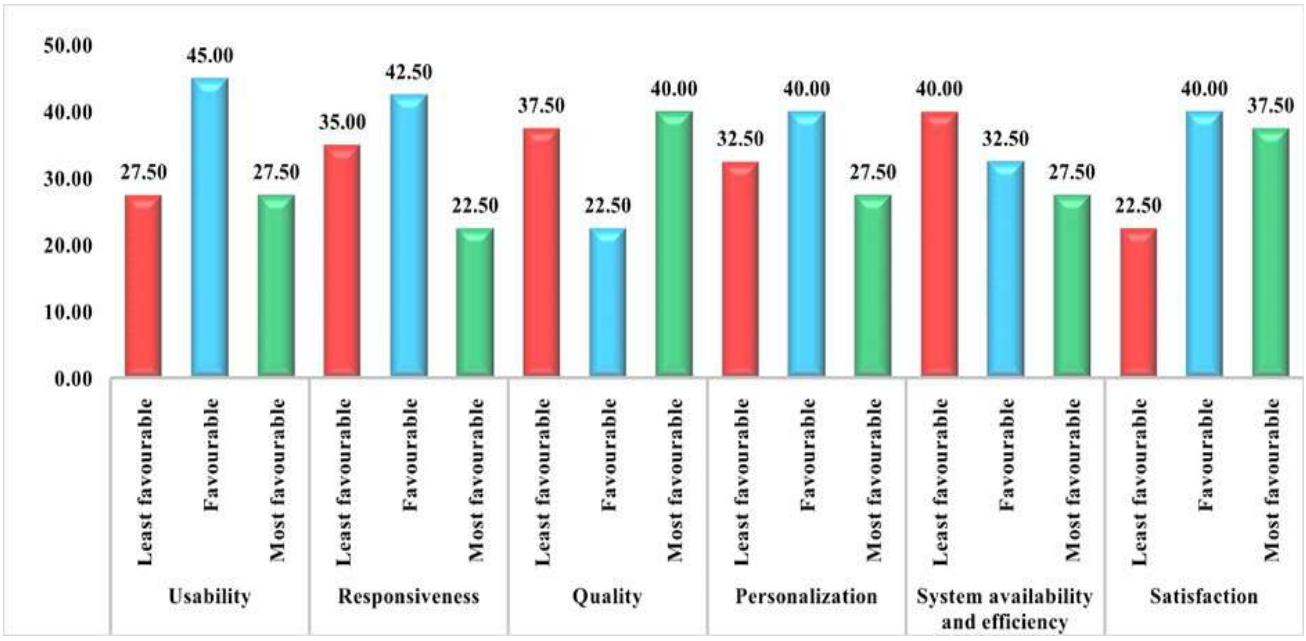

Fig. 1: Dimension wise distribution of respondents

TABLE 5

Overall attitude of stakeholders towards digital communication and service

(n=40)

Characteristics	Category	Stakeholders (40)	
		f	%
Overall attitude of stakeholders (Mean 174.58 ½ S.D10.09)	Least favourable (< Mean - ½ SD)	10	25.00
	Favourable (Mean ± ½ SD)	23	57.50
	Most favourable (>Mean ± ½ SD)	07	17.50

Favourable levels (40.00 per cent) emerged as the top frequency category in personalization dimension followed by least favorable (32.50 per cent) and most favorable (27.50 per cent). Least favourable levels (40.00 per cent) emerged as the high frequency group followed by favourable levels (32.50 per cent) and most favourable levels (27.50 per cent) in system availability and efficiency dimension. Favorable levels (40.00 per cent) emerged as high frequency group, followed by most favourable levels (37.50 per cent) and least favourable levels (22.50 per cent). The dimension satisfaction ranked top with mean score of 3.81, followed by system availability and efficiency (3.71), usability (3.63), personalization (3.56), quality (3.53) and least ranked was responsiveness (3.49).

From Table 5 and Fig. 2, it can be observed that more than half of the respondents were belongs to favorable levels (57.50 per cent) among overall attitude towards digital agricultural communications and services, followed by least favorable levels (25.00 per cent) and most favorable levels (17.50 per cent).

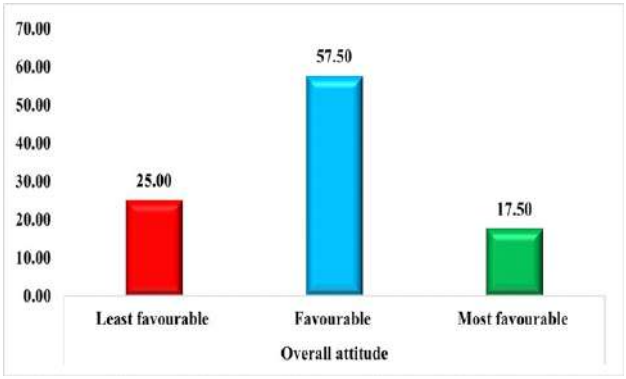

Fig . 2 : Distribution of respondents according to their overall attitude levels

Based on the results it can be suggested that nearly half of the respondents had favorable attitudes in the usability dimension, efforts should be made to further improve the user-friendliness of digital platforms. Conducting user experience assessments and incorporating feedback from stakeholders can help identify areas for enhancement ensuring that the platforms are intuitive, easy to navigate, and accessible to all users. Since responsiveness received the least favorable ranking among the dimensions, it is crucial to address this area promptly. Establishing efficient support mechanisms and dedicated channels for addressing stakeholders' queries and concerns can enhance satisfaction levels. Quick responses and timely assistance can build trust and confidence in digital agricultural communication and services. As a significant proportion of respondents reported favorable attitudes in the quality dimension, ensuring the accuracy, reliability, and up-to-date nature of information is vital. Collaborating with experts and credible sources to verify the information provided through digital channels can enhance stakeholders' trust in the data and advice received.

This study aims at constructing a scale to measure stakeholders' attitude towards digital agricultural communication and services. The affective aspects of attitude scale consist of 48 items under six dimensions. The scale can be used in future studies on perceptions, feelings and attitudes of stakeholders of agriculture towards digital agricultural communication and services. The findings from the six dimensions highlight specific areas of strengths and opportunities for improvement in digital agricultural communication and services. By incorporating the above suggestions,

stakeholders and providers can work collaboratively to enhance the overall attitude towards digitalization in agriculture, leading to increased adoption, efficiency and effectiveness in leveraging digital technologies for agricultural development in India.

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