Development of a Standardized Likert Scale to Gauge Extension Personnel Attitude Towards ICT

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Original Research Article	

ABSTRACT

Information and communication technology (ICT) is readily assisting extension workers towards addressing various obstacles of agricultural extension system. Major responsibility of extension is to disseminate information, skills, and attitudes that are not readily acquired through formal education. In light of this, a standardized scale was developed based on the technique of scale construction devised by Rensis Likert also known as summated rating scale. The procedure began with dimension identification, item collection, relevancy and item analysis, reliability and validity checks to ensure accuracy and consistency of the results. A list of tentative 80 items which intends to measure attitude towards ICT was collected for the relevancy test. One hundred judges were approached online using Google forms for relevancy of statements. In order to find out the discriminating index for each item, 't' score value was calculated using the formula and procedure

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given by Edwards. Finally, 19 statements made up the final scale based on the relevancy test and 't' score values more than 1.75 resulting from item analysis. Cronbach's alpha value was found to be 0.70 and Spearman-Brown coefficient was found to be 0.55 which depicted high reliability. Furthermore, the Spearman-Brown Prophecy formula was used to calculate the overall test reliability, which was found to be 0.55. Expert opinion on 19 items for content validity and coefficient of correlation the validity and reliability measures of the scales indicated the precision and consistency. Policymakers would find it easier to make the proper decisions by using the standardized scale to practically assess the attitude level of extension personnel towards ICT use in extension services.

1. INTRODUCTION

Agriculture has applied the concept of ICT to deliver relevant information among its stakeholders. Agricultural extension involves transferring of information and agricultural technologies from research labs to farmers; providing advisory services to farmers by supporting their decision-making; educating the farmers; and empowering them to realize their goals [1]. The public extension in present conditions cannot possibly fulfill qualified manpower as one extension officer served 1162 operation holding, i.e. the ratio of extension workers to operational holding is low at 1:1162 at the national level as against recommended 1:750 which is inadequate to address the information needs of farmers [2]. ICT is regarded as cost-effective and sensible tools to ease delivery of information and knowledge division among stake holders of agricultural extension system [3].

Extension personnel are major part of extension system and are well positioned to access, share or create knowledge over the web [4]. The need of the moment is the use of modern and quick communication channels like ICT to disseminate and create awareness about latest farm technologies among farmers. Smartphones have become widely used ICT devices across the globe [5] and mobile phones with internet connectivity have increased from 744 million users in 2020 to 930 million users by the year 2022 [6]. Hence, an immediate need arises to adopt ICT by extension personnel to increase their uptake of e-learning and increase efficiency and productivity of agricultural extension services due to which it becomes a priority to understand attitude of extension personnel towards ICT.

"Attitude is increasingly being recognized as an important aspect of the ones personality. It is an organized predisposition to think, feel, perceive and behave towards a cognitive object. Attitudes are individually attributed emotions, beliefs and behavioral tendencies towards a specific abstract or concrete object" [7]. "Attitude is a personal disposition common to individuals, but varying in degrees, which impels individuals to react to object, situations or prepositions in ways that can be called favourable or unfavourable" [8]. "Likert's technique of scale construction is most popular form of attitude measurement and referred as attitude scale as they are derivation of a scaling procedure developed by Rensis Likert. Attitude scale developed from this technique comprised of a set of statements or items that scale a respondent's level of agreement, favorability or other similar perception. It has been a long time need for a proper scale to measure the attitude of extension personnel towards ICT use for day to day extension services in agricultural extension system, it was thought necessary to construct a scale for the purpose. Keeping this in view, an attempt has been made to develop a scale for measuring the attitude of extension personnel towards ICT" [7]. Therefore, the present study was contemplated to develop a standardized summated rating scale for measuring attitude level towards ICT for extension personnel working in Punjab state towards which can contribute to inform scientific and policy discussions on ICT based extension delivery system.

2. MATERIALS AND METHODS

The research was conducted during the year 2023 in Punjab Agricultural University. For measuring the attitude, different types of scales are available but Likert's Summated rating scale [9] was used in the present study. The scale was devised to measure attitude level of extension personnel working in Krishi Vigyan Kendra (KVK) of Punjab state towards the use of ICT in day to day extension activities. Attitude for the present study is operationalized as the degree of positive

or negative feeling associated with ICT use and its features. All the systematic steps were followed for the scale construction i.e. Item Collection, Relevancy Test and Selection of Items, Item Analysis by computation of 't' score values, Reliability Test and Validity Test. Possible statements concerning the psychological object 'attitude' was collected based on review of literature and discussion with experts. In total a collection of tentative 80 items were prepared initially which were organized and structured in form of an attitude items. The items were screened by following the fourteen (14) informal criteria suggested by Edwards [10] for editing and restructuring the statements. Based on the screening, 51 items which formed the universe of content were selected. The selected items include both positive and negative statements. To know the relevancy of each item, the list of 51 statements was sent to randomly selected 100 judges who were experts in domain of agricultural extension from ICAR and agricultural scientists working in Punjab Agricultural University. Out of 100 judges only 60 of them responded back in a time frame of one month with their ratings on a five-point continuum, ranging from, most relevant to not relevant. The judges were also asked to make necessary modifications, addition or deletion of the statement based on their judgments. Based on their judgment relevancy scores were measured towards ICT using the following formulae.

a) Relevancy Percentage (RP) It was obtained by using the following formula:

R.P.=MR×5+R×4+SWR×3+LR×2+NR×1 / Maximum possible score ×100

b) Mean Relevancy Score (MRS) It was worked out using the following formula:

$$M.R.S. = \frac{MR \times 5 + R \times 4 + SWR \times 3 + LR \times 2 + NR \times 1}{\text{No. of judges responded}}$$

Where, MR= Most relevant, R=Relevant, SWR= Somewhat relevant, LR= Least relevant and NR=Not relevant

The final statements for scale were selected by calculating their 't' value for each item. It is a measure of the extent to which a given item differentiates between the high and the low group. The statements with the t-value equal to or more than 1.75 were selected for the final attitude scale, which indicates that average

response of a high and low groups differs significantly. The scores obtained by the respondents were summed up and arranged in descending order. The 25 percent of the respondents with highest total score (the high group) and 25 percent of the respondents with the lowest total score (the low group) were selected for the analysis to calculate the t-value using the following formula:

$$t = \frac{XH - XL}{\sqrt{\sum (XH - XH)2 + (XL - XL)2 \; / n(n-1)}}$$

Where, XH= the mean score on a given statement for the high group, XL= the mean score on a given statement for the low group, $\sum (XH - \bar{x}H)^2$ = the variance of the distribution of responses of the high group to the statement, $\sum (XL - \bar{x}L)^2$ = the variance of the distribution of responses of the low group and t = the extent to which a given statement differentiate between high and the low group.

Scale consistency was measured by employing Cronbach's alpha method which is called coefficient of reliability to identify how closely set of items are related. It was measured to determine correlation among set of items in scale. Validity of scale was found using content validity to ascertain that the scale is a representative of all aspects of construct and to make conclusions about trustworthiness of scale and to know how accurately scale will test what it intends to measure.

3. RESULTS AND DISCUSSION

An objective methodology was devised in order to select the attitude items keeping in mind that the selected statements should adequately represent the respective content with respect to ICT, as far as possible. Items with high t- score values were selected and care was taken to include approximately equal number of positive and negative statements which are capable of differentiating the feeling of extension personnel towards use of ICT. Thereby, 19 items were selected for final scale using the procedure described in detailed under this section.

3.1 Item Collection

"In item collection process, an item pool of 80 statements related to the study was collected

through review of literature as well as consultation with experts. The set of 80 statements were carefully analyzed by a panel of six experts in the field of scale construction techniques, extension education scientists and two experienced sociologists from Punjab Agricultural University. Finally after rigorous discussions with experts, a total of 51 items that are phrased specifically towards measure of construct were retained out of 80 statements. Each statement was checked on the basis of 14 criteria" suggested by Edward [10].

3.2 Relevancy Test and Selection of Items

All the statements collected may not be relevant equally in measuring the attitude of extension personnel towards ICT. Hence, relevancy test is the procedure to scrutinize the items for final inclusion in scale; in the procedure the selected items were sent to the experts who comprised of ICAR scientists, Subject matter specialists in KVK, Agricultural Extension scientists from State Agricultural Universities, Agricultural Scientists from Directorate of Extension who had

knowledge in ICT for critical evaluation and their expert judgment on the relevancy of the statements collected. To know relevancy of selected 51 items, it was administered to 100 judges through individual visits, e-mail as well as Google survey form. The responses were received from judges in a time span of 30 days and they were asked to check each of the statement carefully whether relevant or not using five point continnum as highly relevant (5), relevant (4), somewhat relevant (3), irrelevant (2) to highly irrelevant (1). Judges were also requested to make necessary modifications and additions or deletions of words, sentences, as desired. The results of mean relevancy test reveals that out of 51 items that were subjected to relevancy test, 29 items made it to the cutoff point of relevancy test. Accordingly, statements having relevancy percentage of more than 69 per cent and mean relevancy score more than 3.47 were considered for further analysis of statements (Table 1). Hence, 29 attitude statements were selected after analysis on basis of relevancy test. These statements were suitably modified and written as per the comments of the judges wherever applicable.

Table 1. Relevancy percentage (RP) and Mean relevancy score (MRS) of the statements based on the response of the judges

S.No.	Statements	RP	MRS
1.	I have interest in using ICT*	87.33	4.36
2.	Use of ICT provides an opportunity to update knowledge of an extension officer*	91.33	4.56
3.	Traditional methods of extension services are more reliable than ICT based extension services*	79	3.95
4.	Use of ICT is very time consuming*	85.66	4.28
5.	Videos are very useful for educating farmers on improved practices And technologies*	81.33	4.06
6.	Mobile is very useful in connecting with farmers*	79	3.95
7.	ICT infrastructure is costly*	75.33	3.76
8.	ICTs cannot demonstrate complex farm technology in easier way	43.33	2.16
9.	Accessing agricultural websites are good source of information for Field functionaries*	82.66	4.13
10.	ICT satisfy basic needs of extension personnel	58.66	2.93
11.	ICT reduce the workload of KVK staff and enhance the productivity of scientists*	75	3.75
12.	It is difficult to use ICT in field situations*	74.33	3.71
13.	ICTs reduce interpersonal relationships between farmers and extension personnel	57.33	2.86
14.	Use of statistical packages is not necessary for analysis of agricultural extension data	59.33	2.96
15.	Monotony of work can be reduced by using ICT*	84.33	4.21
16.	ICT has potential to improve credibility of agricultural extension system	59.66	2.98
17.	Uses of ICTs enhance transfer of technology*	86	4.3

S.No.	Statements	RP	MRS
18.	I feel mentally tired while using ICT for extension work*	72.33	3.61
19.	ICT help in improving Research – Extension – Farmer – Market linkage*	76.33	3.81
20.	Most of my time is wasted in browsing of information	68.33	3.41
21.	ICT utilization hampers practicality of an extension activities	54.33	2.71
22.	Feedback is fast through ICT*	79	3.95
23.	Face to face communication is enough for extension work	48.33	2.41
24.	ICTs widens the vision of an extension officer	56.66	2.83
25.	ICT helps in reducing physical stress*	75.66	3.78
26.	ICT enhances decision making capacity of extension workers*	81	4.05
27.	The cost of demonstrations and trainings gets reduced with use of ICT	49	2.45
28.	Constant up date of content on ICT is required in local language*	76	3.8
29.	ICT creates problems to inexperienced extension personnel who lacks knowledge with online technologies	59.33	2.96
30.	ICT use can increase the working capability of and capacity of extension personnel*	84.66	4.23
31.	Wider ratio of the farmers to the extension worker (1162:1) can be bridged by using ICT*	85.33	4.26
32.	ICT is very fast way to connect with farmers*	83.66	4.18
33.	ICT use is difficult to transfer relevant information	59.66	2.98
34.	Existing ICT infrastructure is not efficient	61.33	3.06
35.	Computer literacy is necessary for internet browsing*	77.33	3.86
36.	ICT are not suitable for extension activities in rural areas due to frequent power cut*	82.33	4.11
37.	ICT motivates farmers*	76.66	3.8
38.	Level of literacy of extension functionaries determine their level of understanding of ICT applications	58.33	2.91
39.	Information of new research findings can be communicated through ICTs by research institutions*	72.66	3.63
40.	KVKs should purchase ICT tools for its frontline staff*	77.33	3.86
41.	Existing speed of internet in my institute is not fast	65	3.25
42.	Technical efficiency is not required among extension staff	59.66	2.98
43.	I received ICT training from college of study as a part of course	47	2.35
44.	KCC provide information in local language.	46.66	2.33
45.	Due to busy network of KCC farmers have to wait for long time for getting the advice from KCC experts	49.66	2.48
46.	Extension functionaries do not consider KCC as a credible source of Information	56.33	2.81
47.	Mobile is an emerging ICT tool for extension work in India*	70.66	3.53
48.	Mobile phone reducesthe social isolation among farming communities *	74.33	3.53
49.	ICT use is difficult to transfer relevant information	60	3
50.	ICT is necessary for agricultural and rural development*	77.33	3.86
51.	E-literacy is necessary for ICT use by the farmers	59.66	2.98

selected statements on basis of relevancy test

3.3 Item Analysis and Computation of 't' Values

"Item analysis is an important step in constructing a valid and reliable scale. The purpose of item analysis is to determine how well each item is discriminating between people having different attitude. For this, a pilot survey was conducted in non-sampled area and 29 items that satisfied the criteria for relevancy test (i.e. above relevancy mean score) was administered on 60 extension personnel. They were asked to indicate their degree of agreement on a five point continuum namely; Strongly

agree, Agree, Undecided, Disagree and Strongly disagree with scores of 5 to 1 for each positive statements and 1 to 5 for each negative statements respectively. For the purpose of evaluating the statements the respondents were arranged in descending/ ascending order based on their individual scores. After that, criterion group was selected, i.e. 25 per cent of the respondents having the low score/group and 25 per cent having the high score/group were taken. The final scale was constructed by computing t-values as suggested in method of summated rating scale" [9]. The score for their response was summed up and arranged in a descending order.

After computing 't' value for all the items, 19 statements with highest 't' value equal to or greater than 1.75 were selected. The thumb rule of rejecting items with 't' value less than 1.75 was followed as suggested by, Edward (1957). As per the thumb rule selection of items to be retained in the scale, includes the scales with highest discriminating values excluding the scales with poor discriminating ability and questionable validity. Thus, 19 statements were retained for consideration in the final scale based on the following norms:-

- The 't' value should be more than 1.75
- The statement should present a new idea (the idea not overlapping with that expressed other)
- The statement should be simply worded and brief.

The results shown in Table 2 revealed t-value of the items that were able to differentiate between the high and the low group.

3.4 Description of the Final Attitude Scale

"The final standardized version of the scale would measure attitude of extension personnel towards ICT which contains 19 items consisting of both positive and negative statements" (13,6). Those statements will be placed randomly in the scale in order to obtain most honest responses. All the items are framed on a five point continnum. In case of positive statements, strongly agree, agree, neutral, disagree and strongly disagree were scored as 5,4,3,2,1, while reverse coding was done for negative statements respectively. The score obtained for each statement would be summed up to arrive at the attitude score for the respondents. The score will range from maximum to minimum on a particular value. Maximum score would indicate a favourable attitude and minimum score indicated an unfavourble attitude towards ICT. The respondents would be categorized as 'less favourable', 'moderately favourable' and 'highly favourable' after getting the total attitude score based on the range values of the attitude score possible.

3.5 Reliability Test

A scale is reliable when it accurately measures what it intends to measure whenever it is applied into practical use. According to Guilford [11] reliability is the proportion of the true variance in obtained test scores. Kerlinger [12] refers reliability as the accuracy or precision of measuring score of an instrument. Kerlinger [12] opined that "when a test gives consistently the same results when applied to the same sample, the test is said to be reliable. This is most crucial to attitude scale construction as it shows the strength of the attitude scale. The designed scale was tested for its reliability using Cronbach's alpha method. Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability. The value of Cronbach's alpha was found to be 0.70 showing that the scale has good internal consistency and thus, the scale was reliable".

3.6 Content Validity Test

The validity of the scale was established through content validity *i.e.*, the representativeness or sampling adequacy of the content of a measuring instrument Chovatia et al. [13] The scale satisfies both these criteria as the clause of universe of statements that could be made about utilization of ICT tools in Agricultural Education formulated from the standards and also in consultation with experts. Care was taken for obtaining a fair degree of content validity. Once a final list of proposed items was developed, a panel of experts reviewed the scale to establish content validity. The 19 final statements were given to 20 judges for their expert guidance and the suggestions given by the experts were included in the scale and therefore the scale satisfied content validity. Also intrinsic validity was found to be 0.55. The calculated "t" value being significant for all the finalized statements of the score indicated that the attitude statements of the scale have discriminating values. Hence, it seems reasonable to accept the scale as a valid measure of the perception and acceptance [14,15].

Table 2. Item analysis of statements administered to the extension personnel

S. No.	Statements	t-value
1.	I have interest in using ICT	1.50
2.	Use of ICT provides an opportunity to update knowledge of an extension officer	1.99
3.	Traditional methods of extension services are more reliable than ICT based extension services	2.21
4.	Use of ICT is very time consuming	1.80
5.	Videos are very useful for educating farmers on improved practices and technologies	1.33
6.	Mobile is very useful in connecting with farmers	1.42
7.	ICT infrastructure is costly	-1.68
8.	Accessing agricultural websites are good source of information for field functionaries	3.13
9.	ICT reduce the workload of KVK staff	-3.19
10.	It is difficult to use ICT in field situations	3.25
11.	Monotony of work can be reduced by using ICT	1.24
12.	Uses of ICTs enhance transfer of technology	2.05
13.	I feel mentally tired while using ICT for extension work	3.05
14.	ICT help in improving Research – Extension – Farmer – Market linkage	-1.83
15.	Feedback is fast through ICT	1.79
16.	ICT helps in reducing physical stress	2.12
17.	ICT enhances decision making capacity of extension workers	-3.94
18.	Constant up date of content on ICT is required in local language	-4.39
19.	ICT use can increase the working capability of and capacity of extension personnel	3.57
20.	Wider ratio of farmers to the extension worker (1162:1) can be bridged by using ICT	1.92
21.	ICT is very fast way to connect with farmers	1.78
22.	Computer literacy is necessary for internet browsing	1.90
23.	ICT are not suitable for extension activities in rural areas due to frequent power cut	-1.95
24.	ICT motivates farmers	1.67
25.	Information of new research findings can be communicated through ICT by research institutions	1.56
26.	KVKs should purchase ICT tools for its frontline staff	1.33
27.	Mobile is an emerging ICT tool for extension work in India	2.43
28.	Mobile phone reduces the social isolation among farming communities	1.65
29.	ICT is necessary for agricultural and rural development	1.56

Table 3. The Final Attitude scale statements for measuring attitude of extension personnel towards ICT

S.No.	Final Statements	t-value
1.	Traditional methods of extension services are more reliable than ICT based extension services	2.21
2.	Use of ICT is very time consuming	1.80
3.	Accessing agricultural websites are good source of information for field functionaries	3.13
4.	ICT reduce the workload of KVK staff	-3.19
5.	It is difficult to use ICT in field situations	3.25
6.	Uses of ICTs enhance transfer of technology	2.05
7.	I feel mentally tired while using ICT for extension work	3.05
8.	ICT help in improving Research – Extension – Farmer – Market linkage.	-1.83
9.	Feedback is fast through ICT	1.79
10.	ICT helps in reducing physical stress	2.12
11.	ICT enhances decision making capacity of extension workers	-3.94
12.	Constant up date of content on ICT is required in local language	-4.39
13.	ICT use can increase the working capability and capacity of extension personnel	3.57
14.	Wider ratio of farmers to the extension worker (1162:1) can be bridged by using ICT	1.92
15.	ICT is very fast way to connect with farmers	1.78
16.	Computer literacy is necessary for internet browsing.	1.90
17.	ICT are not suitable for extension activities in rural areas due to frequent power cut	-1.95
18.	Mobile is an emerging ICT tool for extension work in India	2.43
19.	Use of ICT provides an opportunity to update knowledge of an extension officer	1.99

4. CONCLUSION

Development of a standardized scale is a contribution to the body of knowledge in the field of social sciences and behavioral science. This study aims at constructing a scale to measure the attitude of extension personnel towards ICT. There are 19 statements in the affective portion of the attitude scale, and they have higher predictive validity and high reliability. This measure was created to gauge how KVK extension staff members feel about utilizing ICT to provide extension services. Previous research indicates that the majority of instruments now in use are tailored for wealthy countries and may not be as applicable to emerging nations. Thus, in order to get around the constraints, a new scale has been developed in order to comprehend the extension staff's point of view in the current situation. The scale was checked for its content validity by taking the opinion of experts during its construction process and found to be having good internal consistency of 0.70. Like any other tool it has certain limitations like prior standardization that need to be considered before its use outside India. The standardized attitude scale will fill the gap in the literature related to assessment of attitude towards ICT uptake among extension personnel. This scale can be used in future studies on attitude and feeling about the extension personnel towards ICT. It will be helpful to the policy makers and administrators to develop suitable strategies towards ICT by knowing the attitude of extension personnel also serve as a valuable tool for further attitude studies by researchers and social organizations involved in promoting ICT. Hence, the development of the scale has indicated that this tool is reliable and valid, and can prove valuable in assessing the attitude level of extension personnel towards ICT.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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