

# Development of A Scale for Assessing Farmers' Knowledge of ICT-based Agricultural Advisory Services in Bangladesh

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**Abstract:** The agriculture sector is increasingly becoming knowledge-intensive where farmers require more information. ICT-enabled services help in disseminating timely information and agricultural advisories to enrich farmers' capacity and empower them with contemporary farming technologies and techniques in Bangladesh. To measure farmers' level of knowledge on the utilization of ICT-based Agricultural Advisory Services (AASs) in Bangladesh, there was no standardized scale available. The goal of this study was to build and standardize the scale. Initially, 54 items were collected after thorough consultation with relevant experts and available literature. Then, 36 statements were selected where six items from each of the six levels of the cognitive domain. After conducting a pre-test on 24 farmers (four farmers from each six districts of three agricultural regions) of the representative part of the research population, was selected. Through item analysis the difficulty index values ranging from 20.83 to 70.83 and the discrimination index values ranging from 0.25 to 0.75 were included in the final format of the knowledge scale in the current study. The aforesaid procedures indicate that the face, content, construct and ecological validity were all built during its construction. Moreover, Cronbach's coefficient alpha value (0.922) and split half value (0.922) of items indicated very strong internal consistency and reliability of the items. With the proper changes, this scale can be used to assess farmers' knowledge of ICT outside the research area.

**Keywords:** Knowledge scale, ICT, Agricultural Advisory Services, Difficulty, Discrimination

## I. INTRODUCTION

Digital agriculture can drive the transformation of agri-food systems necessary to eliminate hunger, reduce poverty and build a stronger future for all humanity (FAO, 2021). The agriculture sector is increasingly becoming knowledge-intensive where farmers require more information to make complex decisions on their land use, selection of crops, flexibility in the choice of markets for their produce and other necessary decisions that impact their lives. Using ICT in innovative ways through ICT-enabled services helps in disseminating timely information and agricultural advisories to improve farmers' capacity and empower them with contemporary farming technologies and techniques (The Daily Star, 2015).

Though there has been substantial investment in the application of ICT in agriculture by the Government of Bangladesh for over a decade, digital literacy among farmers remains low and there is no extensive real-time data for effective decision-making (General Economics Division, 2020). Farmers are the most important client link in the ICTs network in agricultural development. In the fast-growing face of ICTs in agriculture, information about the utilization of ICTs by Bangladeshi farmers is scattered and very low. Moreover, understanding the knowledge of ICTs of Bangladeshi farmers is an important study for proper management and future planning of this sector. Thus, this study was carried out with the prime objective of developing a scale to measure the farmers' level of knowledge of ICT-based agricultural advisory services (AASs) in Bangladesh.

## II. METHODOLOGY

In this study, knowledge is defined as the behavior and test situations that emphasize remembering, either by recognition or recall of ideas, materials, or phenomena (Bloom *et al.*, 1956). This variable indicated the respondents' level of ICT knowledge at the time of the interview, as determined by their responses to a set of questions designed logically and scientifically for this purpose. The steps taken in developing the scale for the knowledge test for this study are shown in the flow-diagram (Figure 1).

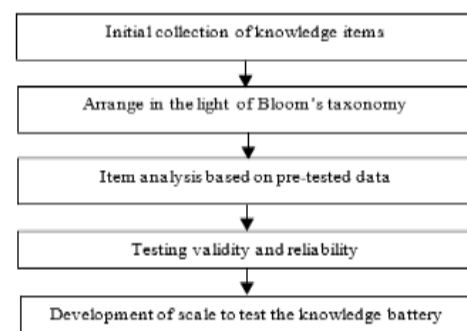


Fig. 1 Flow-diagram shows the steps involved in the development of a scale to test farmers' knowledge of ICT-based agricultural advisory services (AASs)

Collection of items

The knowledge test’s content is made up of questions known as items. Items for the test were gathered from a variety of sources including literature, agricultural extension personnel, agricultural extension academicians and extension scientists, NGO personnel, progressive farmers and the researcher’s own experience thus ensuring all crucial areas. The collected items were discussed with expert extension officials and extension educationists for the relevance of the items and for alteration and addition of the items. The items for the test were chosen with the following criteria in mind:

Instead of just rote memorization, the test question should require thought. The item should distinguish between farmers who are well informed and those who are not and it should have a minimum level of difficulty. All areas of

knowledge should be covered by the items included. With these criteria in mind initially, 54 relevant items were accumulated to assess farmers’ knowledge level of ICT-based AASs which ensures face and content validity of the scale.

Arrange in the light of Bloom’s revised taxonomy

The items were chosen using Bloom’s (1956) revised taxonomy, as devised by Anderson and Krathwohl (2001). The items included remembering, understanding, applying, analyzing, evaluating and creating questions about the utilization of ICT-based AASs. Following the aforementioned criteria, 36 questions were chosen from the initial 54 questions, six from each of remembering, understanding, applying, analyzing, evaluating and creating (Table 1).

Table 1: Items of knowledge on the utilization of ICT-based agricultural advisory services (AASs)

| Sl. No of item | Questions   |
|----------------|---|
| 1. REMEMBERING |   |
| 1.a            | Which of the following are e-Agriculture mobile apps?<br>Krishoker Janala/Krishi Projukti Vander/Rice Knowledge Bank<br>Google drive<br>None of the above   |
| 1.b            | Mention the name of a TV program for getting agricultural information.<br>Mati O Manush/Hridoye Mati O Manush<br>Prokiti O Jibon<br>None of the above.  |
| 1.c            | What is the dial or hotline number of the Krishi call center?<br>109                              b) 16123                              c) 999  |
| 1.d            | Which of the following is the name of a social media site?<br>Mozilla Firefox/Google Chrome/Internet explorer<br>Facebook/Youtube<br>Google/Yahoo   |
| 1.e            | Which of the following is the part of a computer?<br>Multiplug                              b) Monitor                              c) Internet   |
| 1.f            | Which of the following ICT-based media is the most frequently used for getting agricultural information in your locality?<br>Mobile                              b) Laptop                              c) Computer   |
| UNDERSTANDING  |   |
| 2.a            | What do you mean by the internet?<br>It is a global system of interconnected computer networks.<br>It is a network between two computers<br>None of the above   |
| 2.b            | What is the elaboration of ICT?<br>Information and Communication Technology<br>Internet and Communication Technology<br>Indigenous Common Technology  |
| 2.c            | What is the most appropriate regarding social media?<br>Social media like Facebook, YouTube, WhatsApp, etc. are the global virtual platforms that interconnected billions of people to share or get information.<br>Social media is used particularly by a specific society.<br>Social media is used for entertainment purposes only. |
| 2.d            | What is the most appropriate regarding Mobile phones?<br>A cellular phone or cell phone that connects a wireless communication network.<br>A device with communication techniques only.<br>A telecommunication device that provides only voice calls.   |
| 2.e            | What is the most appropriate regarding Radio?<br>An electronic audio medium is used for broadcasting.<br>Only educated people can take advantage of this medium and build up adequate knowledge and skill.<br>It is very difficult to use.  |
| 2.f            | What is the most appropriate regarding Television?<br>An electronic audio-visual medium is used for broadcasting.<br>Rich and educated people can take advantage of this medium.<br>TV programs cannot be watched through mobile using the internet.  |

| Sl. No. of item   | Questions  |
|-------------------|--|
| <b>APPLYING</b>   |  |
| 3.a               | What procedures need to start a computer?<br>Connecting to the power supply, then switch on the start button.<br>Starting a computer depends upon the power supply only.<br>None of the above.   |
| 3.b               | How can you save your computer and smartphone from virus attacks?<br>By running anti-virus.<br>By using a cleaning agent.<br>By covering with a cloth or back part.  |
| 3.c               | How can you take a photograph?<br>By using a mobile camera.<br>By using a digital camera.<br>Both of the above.  |
| 3.d               | How can you get internet connectivity?<br>By using a mobile data connection.<br>By using a modem.<br>Both of the above.  |
| 3.e               | How can you open a webpage/website?<br>Typing the address of a webpage/website in the browser with an internet connection and then click.<br>Typing the address of a webpage/website in the browser without an internet connection and then click.<br>I don't know.  |
| 3.f               | How can you listen to the FM radio program?<br>One can listen to FM radio programs by using a mobile phone.<br>It is not possible without a radio set.<br>None of the above.   |
| <b>ANALYZING</b>  |  |
| 4.a               | Why is a mobile phone suitable for extension activities?<br>Easy, cheap, and quickly accessible.<br>Only a voice call is possible.<br>I don't know.  |
| 4.b               | Why is the agricultural mobile app more suitable for extension activities?<br>There is no authenticity problem.<br>All apps could be accessed in offline mode.<br>Easy to understand because the Bengali version is available.   |
| 4.c               | Why is call centers gaining popularity day by day?<br>No technical knowledge is required to make a call.<br>It is possible to get direct interaction with the subject matter expert.<br>Both of the above.   |
| 4.d               | What is the advantage of the farm broadcasting programs?<br>A mobile phone could act as a radio (FM bandwidth) for listening to farm broadcasting programs.<br>An illiterate farmer could access farm information.<br>Both of the above.   |
| 4.e               | Which is the false statement regarding the utilization of social media for farm information?<br>Anybody can share anything so there is a chance to get fake information.<br>Rapid dissemination of farm information is possible through social media.<br>Only text material is available on social media but no video material.                                  |
| 4.f               | Why is password used in ICT-based media?<br>To make secure use.<br>To make it reliable.<br>To make it easy to handle.  |
| <b>EVALUATING</b> |  |
| 5.a               | What is your opinion about the present situation of ICTs in agricultural extension?<br>It can save time, visits and money.<br>It is possible to get real-time problem-solving.<br>Both of the above.   |
| 5.b               | Make correct judgments of the ICT-based agricultural advisory services compared to traditional extension services.<br>It is easy to get an expert opinion in the quickest possible time.<br>It is possible to escape physical contact.<br>Both of the above.   |
| 5.c               | What is the limitation of searching for information using the internet?<br>Huge related information comes at a time.<br>It is difficult to make a decision about which information is the most suitable.<br>Both of the above.   |
| 5.d               | What opinion is correct about the present situation of agriculture-related TV programs?<br>Many TV channels are emphasizing telecast agricultural news/special programs for agriculture, thus motivating farmers.<br>Once you missed a program to watch, you missed forever, it is not possible to retrieve the program from the internet.<br>None of the above. |

| Sl. No. of item | Questions   |
|-----------------|---|
| 5.e             | What type of ICT-based media is suitable for agricultural extension services considering time, money, and efficiency?<br>a) Audio-based      b) Visual based      c) Both audio and visual-based.   |
| 5.f             | Which one of the following ICT tools is the easiest one to contact with an extension agent or agricultural expert?<br>a) Mobile phone      b) Telephone<br>c) I don't know.   |
| CREATING        |   |
| 6.a             | How can you get a new mobile app (android)?<br>a) Download and install through the play store.<br>b) Sharing from one mobile to another mobile.<br>c) Both of the above.  |
| 6.b             | How can you get farm information from the internet?<br>a) Searching through an internet browser.<br>b) Sharing internet from one mobile to another mobile.<br>c) None of the above.   |
| 6.c             | How can you increase the storage capacity of a mobile?<br>a) By inserting a memory card with more storage capacity.<br>b) By installing/downloading new software.<br>c) None of the above.  |
| 6.d             | How can you transfer data from your computer?<br>a) Through pen drive/data cable/Bluetooth etc.<br>b) Through modem.<br>c) Through multimedia projector.  |
| 6.e             | How can you send quickly the image of an infected plant to an expert from a distant place?<br>a) There is no way of sending images to a distant place.<br>b) Sending the captured picture to an expert through email/messenger etc.<br>c) Capturing, printing, and sending the image through the post office. |
| 6.f             | How can you get direct expert opinion from a distant place?<br>a) There is no way of getting an expert opinion from a distant place.<br>b) Dial short code of call center/helpline number for getting an expert opinion.<br>c) I don't know.  |

### Item analysis

A knowledge test item analysis typically yields two types of information: item difficulty and item discrimination. The item difficulty index indicates how difficult an item is, whereas the discrimination index investigates the extent to which an item discriminates against well-informed farmers from poorly informed farmers. The items were analyzed using pre-test data collected from 24 farmers. Four farmers were selected from each six districts (Rangpur, Lalmonirhat, Dinajpur, Thakurgaon, Narsingdi and Gazipur) of three agricultural regions (Rangpur, Dinajpur and Dhaka) from the representative part of the research population. These pre-test sample farmers should be excluded from the main study's sample farmers. Each of the 36 items had three possible answers, one of which was correct. With respect to each item, each of the 24 respondents who participated in the test received one (1) score for the 'correct' answer and zero (0) score for the 'wrong' or no answer. The respondent's knowledge score was determined by the total number of correct answers he provided out of 36 items. The maximum score was obviously 36, which could be obtained if all 36 items were correctly answered (Mukherjee *at. al.*, 2019). Table 3 displays the correct answer scores of all 24 respondents for each item.

*Calculation of difficulty index:* A formula adopted by Ali (2008) was used to calculate difficulty index of an item:

$$P_i = \frac{n_i}{N_i} \times 100$$

Where,

$P_i$  = Difficulty index in percentage of  $i^{\text{th}}$  item

$n_i$  = Number of farmers giving incorrect answer to  $i^{\text{th}}$  item

$N_i$  = Total number of farmers to whom  $i^{\text{th}}$  item was administered,

i.e., 24 in this study

As a result, the formula calculated the difficulty indices for all 36 items. It was made certain that both extremely difficult and extremely simple items were eliminated. The underlying assumption in item difficulty statistics was that difficulty was linearly related to an individual's level of ICT knowledge. When a respondent gave the correct answer to an item, it was assumed that the item was less difficult than his ability to cope with it, as described by Coombs (1950). The difficulty indices are shown in Table 3.

*Calculation of discrimination index:* Calculating the phi-coefficient, as proposed by Perry and Michael (1951), generates the discrimination index. Mehta (1958) developed the  $E^{1/3}$  method to determine item discrimination, highlighting that it was analogous to, and thus a convenient substitute for the phi-coefficient. Singh (1981), Sagar (1983), Ray and Bora (1991), Choudhury (1998), Islam (2000) and

Ali (2008) all used Mehta's (1958) method and computed total scores against all correct responses of each farmer. The farmers were then arranged in descending order of their total scores. The farmers were then divided into six equal groups, each with four farmers, because the total number of farmers in the sample for item analysis was 24. These groups were designated as G1, G2, G3, G4, G5, and G6. The middle two groups, G3, and G4, were eliminated from the discrimination index calculation, leaving only the extreme four groups with high (G1 and G2) and low (G5 and G6) scores (Table 2). Then discrimination index of each item was then determined by using the following formula:

$$E^{1/3} = \frac{(S_1 + S_2) - (S_5 + S_6)}{\frac{N}{3}}$$

Where  $S_1, S_2, S_3, S_4, S_5$  and  $S_6$  are the frequencies of correct answers for each item in the  $G_1, G_2, G_3, G_4, G_5$  and  $G_6$  groups, and  $N$  is the total number of farmers in the item analysis sample. The discrimination indices of all 36 items were calculated using the above-mentioned procedure and are shown in Table 3.

Table 2: Formation of six different groups by arranging in descending order based on scores obtained

| Group | Sl. No. | Form No. | Score | Group | Sl. No. | Form No. | Score |
|-------|---------|----------|-------|-------|---------|----------|-------|
| G1    | 1       | 9        | 34    | G2    | 5       | 24       | 31    |
|       | 2       | 15       | 34    |       | 6       | 19       | 31    |
|       | 3       | 16       | 33    |       | 7       | 6        | 31    |
|       | 4       | 13       | 35    |       | 8       | 2        | 34    |
| G3    | 9       | 11       | 30    | G4    | 13      | 7        | 26    |
|       | 10      | 14       | 30    |       | 14      | 1        | 28    |
|       | 11      | 21       | 30    |       | 15      | 3        | 28    |
|       | 12      | 17       | 31    |       | 16      | 4        | 30    |
| G5    | 17      | 22       | 18    | G6    | 21      | 10       | 7     |
|       | 18      | 12       | 21    |       | 22      | 20       | 13    |
|       | 19      | 23       | 20    |       | 23      | 5        | 18    |
|       | 20      | 18       | 25    |       | 24      | 8        | 18    |

Example of computation of difficulty and discrimination index:

| Sl. No. of Item | Frequencies of correct answers |       |       |       |       |       | Total frequencies |               | Difficulty index (Pi) | Discrimination index ( $E^{1/3}$ ) |
|-----------------|--------------------------------|-------|-------|-------|-------|-------|-------------------|---------------|-----------------------|------------------------------------|
|                 | $S_1$                          | $S_2$ | $S_3$ | $S_4$ | $S_5$ | $S_6$ | Correct answers   | Wrong answers |                       |                                    |
| 1.a             | 4                              | 4     | 4     | 3     | 0     | 0     | 15                | 9             | 37.50                 | 1.00                               |

The following is an example of calculating the difficulty index and discrimination index of an item in relation to ICT knowledge for getting AASs:

Substituting the values for the item number 1.a, the value of difficulty index and that of discrimination index are indicated below:

Difficulty index:

$$P_i = \frac{n_i}{N_i} \times 100 = \frac{9}{24} \times 100 = 37.50$$

Discrimination index:

$$E^{1/3} = \frac{(S_1 + S_2) - (S_5 + S_6)}{\frac{N}{3}} = \frac{(4 + 4) - (0 + 0)}{\frac{24}{3}} = \frac{8}{8} = 1$$

Final selection of items

For the selection of items in the final format of the knowledge test, two criteria item difficulty index and item discrimination index were used. Items with difficulty index values ranging from 20.83 to 70.83 and discrimination index values ranging from 0.25 to 0.75 were included in the final format of the knowledge on ICT for getting AASs scale in the current study (Nimana and Patel, 2021 & Mukherjee *et. al.*, 2019). Again, it was found that the Cronbach's alpha value of 36 items was 0.922. Therefore, the internal consistency or internal reliability of the items was very strong. It means that the scale constructed by using the above procedures was reliable. As a result, 18 items were opted for the final format of the knowledge on ICT scale, three from each of the following categories: remembering, understanding, applying, analyzing, evaluating, and creating (Table 4).

Table 3: Difficulty and discrimination analysis for the final selection of the items

| Sl. No. of Item | Frequencies of correct answers |       |       |       |       |       | Total frequencies |               | Difficulty index (Pi) | Discrimination index ( $E^{1/3}$ ) | Selected/Rejected |
|-----------------|--------------------------------|-------|-------|-------|-------|-------|-------------------|---------------|-----------------------|------------------------------------|-------------------|
|                 | $S_1$                          | $S_2$ | $S_3$ | $S_4$ | $S_5$ | $S_6$ | Correct answers   | Wrong answers |                       |                                    |                   |
| 1.a             | 4                              | 4     | 4     | 3     | 0     | 0     | 15                | 9             | 37.50                 | 1.00                               | Rejected          |
| 1.b             | 4                              | 4     | 4     | 4     | 4     | 4     | 24                | 0             | 0.00                  | 0.00                               | Rejected          |
| 1.c             | 4                              | 3     | 4     | 4     | 3     | 0     | 18                | 6             | 25.00                 | 0.50                               | Selected          |
| 1.d             | 4                              | 4     | 3     | 3     | 2     | 0     | 16                | 8             | 33.33                 | 0.75                               | Selected          |
| 1.e             | 4                              | 4     | 4     | 4     | 1     | 2     | 19                | 5             | 20.83                 | 0.63                               | Selected          |
| 1.f             | 4                              | 3     | 2     | 2     | 3     | 4     | 18                | 6             | 25.00                 | 0.00                               | Rejected          |
| 2.a             | 4                              | 4     | 4     | 3     | 4     | 3     | 22                | 2             | 8.33                  | 0.13                               | Rejected          |
| 2.b             | 4                              | 3     | 4     | 4     | 3     | 0     | 18                | 6             | 25.00                 | 0.50                               | Selected          |
| 2.c             | 4                              | 4     | 4     | 4     | 2     | 0     | 18                | 6             | 25.00                 | 0.75                               | Selected          |
| 2.d             | 4                              | 3     | 4     | 4     | 3     | 1     | 19                | 5             | 20.83                 | 0.38                               | Selected          |
| 2.e             | 4                              | 4     | 3     | 3     | 4     | 4     | 22                | 2             | 8.33                  | 0.00                               | Rejected          |
| 2.f             | 4                              | 4     | 4     | 4     | 4     | 4     | 24                | 0             | 0.00                  | 0.00                               | Rejected          |
| 3.a             | 4                              | 4     | 4     | 4     | 4     | 3     | 23                | 1             | 4.17                  | 0.13                               | Rejected          |
| 3.b             | 4                              | 3     | 4     | 4     | 3     | 1     | 19                | 5             | 20.83                 | 0.38                               | Selected          |
| 3.c             | 4                              | 4     | 4     | 1     | 2     | 2     | 17                | 7             | 29.17                 | 0.50                               | Selected          |
| 3.d             | 4                              | 2     | 3     | 3     | 2     | 2     | 16                | 8             | 33.33                 | 0.25                               | Selected          |
| 3.e             | 4                              | 4     | 4     | 4     | 3     | 1     | 20                | 4             | 16.67                 | 0.50                               | Rejected          |
| 3.f             | 4                              | 4     | 4     | 4     | 4     | 2     | 22                | 2             | 8.33                  | 0.25                               | Rejected          |
| 4.a             | 4                              | 4     | 4     | 2     | 3     | 2     | 19                | 5             | 20.83                 | 0.38                               | Selected          |
| 4.b             | 2                              | 1     | 1     | 0     | 0     | 0     | 4                 | 20            | 83.33                 | 0.38                               | Rejected          |
| 4.c             | 4                              | 4     | 4     | 3     | 1     | 1     | 17                | 7             | 29.17                 | 0.75                               | Selected          |
| 4.d             | 4                              | 4     | 4     | 3     | 1     | 0     | 16                | 8             | 33.33                 | 0.88                               | Rejected          |
| 4.e             | 4                              | 3     | 2     | 4     | 0     | 0     | 13                | 11            | 45.83                 | 0.88                               | Rejected          |
| 4.f             | 4                              | 4     | 4     | 4     | 3     | 0     | 19                | 5             | 20.83                 | 0.63                               | Selected          |
| 5.a             | 4                              | 4     | 4     | 1     | 1     | 2     | 16                | 8             | 33.33                 | 0.63                               | Selected          |
| 5.b             | 4                              | 3     | 2     | 1     | 2     | 1     | 13                | 11            | 45.83                 | 0.50                               | Selected          |

| Sl. No. of Item | Frequencies of correct answers |                |                |                |                |                | Total frequencies |            | Difficulty index (Pt) | Discrimination index | $E_1^{1/3}$ | Selected/Rejected |
|-----------------|--------------------------------|----------------|----------------|----------------|----------------|----------------|-------------------|------------|-----------------------|----------------------|-------------|-------------------|
|                 | S <sub>1</sub>                 | S <sub>2</sub> | S <sub>3</sub> | S <sub>4</sub> | S <sub>5</sub> | S <sub>6</sub> | Total             | Percentage |                       |                      |             |                   |
| 5.c             | 3                              | 3              | 2              | 3              | 0              | 0              | 11                | 13         | 54.17                 | 0.75                 | Rejected    |                   |
| 5.d             | 4                              | 4              | 3              | 2              | 3              | 2              | 18                | 6          | 25.00                 | 0.38                 | Selected    |                   |
| 5.e             | 4                              | 4              | 3              | 4              | 4              | 4              | 23                | 1          | 4.17                  | 0.00                 | Rejected    |                   |
| 5.f             | 4                              | 4              | 4              | 4              | 4              | 4              | 24                | 0          | 0.00                  | 0.00                 | Rejected    |                   |
| 6.a             | 2                              | 2              | 1              | 1              | 1              | 0              | 7                 | 17         | 70.83                 | 0.38                 | Selected    |                   |
| 6.b             | 3                              | 4              | 2              | 4              | 0              | 0              | 13                | 11         | 45.83                 | 0.88                 | Rejected    |                   |
| 6.c             | 3                              | 3              | 4              | 3              | 1              | 0              | 14                | 10         | 41.67                 | 0.63                 | Selected    |                   |
| 6.d             | 4                              | 3              | 2              | 3              | 1              | 0              | 13                | 11         | 45.83                 | 0.75                 | Selected    |                   |
| 6.e             | 4                              | 4              | 4              | 4              | 4              | 3              | 23                | 1          | 4.17                  | 0.13                 | Rejected    |                   |
| 6.f             | 4                              | 4              | 4              | 4              | 4              | 3              | 23                | 1          | 4.17                  | 0.13                 | Rejected    |                   |

**Standardization of the scale**

A scale is considered standard when it has validity and reliability.

|                                     |   |
|-------------------------------------|---|
| <b>A. Validity of the scale:</b>    |   |
| a. Internal validity                |   |
| 1. Face validity                    | The researcher read sufficient literature in order to construct knowledge scale. In order to ensure the face validity of the scale, the researcher consulted with experts, colleagues and concern extension personnel who were involved in similar kind of work.  |
| 2. Content validity                 | Necessary modification of the items was done after pre-testing. The researcher also consulted with statisticians to verify the items and scales which fulfilled the content validity criteria.  |
| 3. Construct validity               | Item analysis of the scale ensures high level of construct validity.  |
| b. External validity                |   |
| 1. Ecological validity              | The scale constructed of this research is applicable to similar area in Bangladesh as it covers six districts of three agricultural regions of Bangladesh which fulfill the ecological validity criteria.   |
| <b>B. Reliability of the scale:</b> |   |
| a. Cronbach's coefficient alpha     | The Cronbach's coefficient alpha value of 36 items was 0.922 which was greater than 0.90. Therefore, it can be said that the internal consistency or internal reliability of the items was excellent. It means that the scale constructed by using the above procedures was reliable.   |
| b. Split half method                | Again, to test the reliability of the test, the split-half method was used in this study (Nimana and Patel, 2021). The 36 items were split into two halves with 18 odd-numbered into one half and 18 even-numbered items in the other. The correlation coefficient between the aforementioned two sets of farmers was calculated and the value was found strongly significant (0.922) at 0.000 level of significance with 22 degrees of freedom. Thus, it could be concluded that the test developed was found highly reliable. |

**III. RESULTS AND DISCUSSION**

Eighteen items were selected in the final scale. These selected items were arranged in the order of Bloom's taxonomy of cognitive domain. Based on the procedures followed mentioned in the methodology section the following scale was constructed to measure farmers' level of

knowledge on the utilization of ICT-based AASs in Bangladesh.

*Scale to assess farmers' knowledge of utilization of ICT-based agricultural advisory services*

After confirming the validity and reliability of the items of the finalized scale to measure farmers' level of knowledge of ICT-based agricultural advisory services was as follows:

Table 4: Final format to measure farmers' level of knowledge of ICT-based agricultural advisory services

| Sl. No. of Item         | Items   |
|-------------------------|---|
| <b>1. REMEMBERING</b>   |   |
| 1.a                     | What is the dial or hotline number of the Krishi call center?<br>109                      b) 16123                      c) 999  |
| 1.b                     | Which of the following is the name of a social media site?<br>Mozilla Firefox/Google Chrome/Internet explorer<br>Facebook/YouTube<br>Google/Yahoo   |
| 1.c                     | Which of the following is the part of a computer?<br>Multiplug                      b) Monitor                      c) Internet   |
| <b>2. UNDERSTANDING</b> |   |
| 2.a                     | What is the elaboration of ICT?<br>Information and Communication Technology<br>Internet and Communication Technology<br>Indigenous Common Technology  |
| 2.b                     | What is the most appropriate regarding social media?<br>Social media like Facebook, YouTube, WhatsApp, etc. are the global virtual platforms that interconnected billions of people to share or get information.<br>Social media is used particularly by a specific society.<br>Social media is used for entertainment purposes only. |
| 2.c                     | What is the most appropriate regarding Mobile phones?<br>A cellular phone or cell phone that connects a wireless communication network.<br>A device with communication techniques only.<br>A telecommunication device that provides only voice calls.   |
| <b>3. APPLYING</b>      |   |
| 3.a                     | How can you save your computer and smartphone from virus attacks?<br>By running anti-virus.<br>By using a cleaning agent.<br>By covering with a cloth or back part.   |
| 3.b                     | How can you take a photograph?<br>By using a mobile camera.<br>By using a digital camera.<br>Both of the above.   |
| 3.c                     | How can you get internet connectivity?<br>By using a mobile data connection.<br>By using a modem.<br>Both of the above.   |
| <b>4. ANALYZING</b>     |   |
| 4.a                     | Why is a mobile phone suitable for extension activities?<br>Easy, cheap, and quickly accessible.<br>Only a voice call is possible.<br>I don't know.   |
| 4.b                     | Why is call centers gaining popularity day by day?<br>No technical knowledge is required to make a call.<br>It is possible to get direct interaction with the subject matter expert.<br>Both of the above.  |
| 4.c                     | Why is password used in ICT-based media?<br>To make secure use.<br>To make it reliable.   |

| Sl. No. of Item      | Items  |
|----------------------|--|
|                      | To make it easy to handle.   |
| <b>5. EVALUATION</b> |  |
| 5.a                  | What is your opinion about the present situation of ICTs in agricultural extension?<br>It can save time, visit and money.<br>It is possible to get real-time problem-solving.<br>Both of the above.  |
| 5.b                  | Make correct judgment of the ICT-based agricultural advisory services compared to traditional extension services.<br>It is easy to get an expert opinion in the quickest possible time.<br>It is possible to escape physical contact.<br>Both of the above.  |
| 5.c                  | What opinion is correct about the present situation of agriculture-related TV programs?<br>Many TV channels are emphasizing telecast agricultural news/special programs for agriculture, thus motivating farmers.<br>Once you missed a program to watch, you missed forever, it is not possible to retrieve the program from the internet.<br>None of the above. |
| <b>6. CREATING</b>   |  |
| 6.a                  | How can you get a new mobile app (android)?<br>Download and install through the play store.<br>Sharing from one mobile to another mobile.<br>Both of the above.  |
| 6.b                  | How can you increase the storage capacity of a mobile?<br>By inserting a memory card with more storage capacity.<br>By installing/downloading new software.<br>None of the above.  |
| 6.c                  | How can you transfer data from your computer?<br>Through pen drive/data cable/Bluetooth etc.<br>Through modem.<br>Through multimedia projector.  |

#### *Scoring system and administering of the scale*

Each item had three alternative answers including one right answer. The respondents were asked to choose the right answer for each item. One (1) score was given for the right answer and zero (0) for the wrong or no answer against each item. The summation of such scores for all the responses of a farmer was the knowledge level of ICT-based AASs score of that farmer.

#### IV. CONCLUSION

The final scale consisted of eighteen items. Using this scale knowledge of ICT-based AASs can be measured. The scale's reliability and validity indicate the precision and consistency of the responses. This scale was standardized for administration. Similar scales may be constructed to measure the level of farmers' knowledge of the ICT-based agricultural advisory services. This scale can also be used to measure farmers' knowledge beyond the study area with suitable modifications.

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