RESEARCH ARTICLE

A Measurement Tool to Study the e-Readiness of Extension Service Providers of Agricultural Research and Development Institutions in Telangana

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ABSTRACT

The traditional approach to agricultural extension was top-down. The scientist, at the top, was the one who created the technology and this technology was disseminated through the extension service to the farmers who had to apply this technology. The process of dissemination of innovation adopts various methods. As a means, ICTs play a key role. Over the last couple of decades ICTs have been playing a pivotal role. Hence it is important to study the e- readiness of various extension service providers of different agricultural research and development institutes as they act as channels between lab to land. Upon review of existing tools to measure e-Readiness, it was felt that there is need for a reliable scale to measure the same. For the construction of the scale, summated rating method suggested by Likert (1932) was followed. Based on a review of literature 55 statements were enlisted initially and 39 statements were finalized for the final construction of the scale. The reliability and validity of the scale were calculated to find out the precision and consistency of the results.

Key words: e-Readiness; Technology; Traditional approach; Extension service providers.

Information and Communication Technology (ICT) in Agriculture is an emerging field focusing on the enhancement of agricultural and other development in India. The agriculture sector is gearing itself to make optimal use of the new information and communication technologies (*Raksha et.al 2016*). The diffusion of ICTs has contributed enormously to the growth of economies in developed and developing nations. It is earnestly facilitating policy framework to ensure an equitable diffusion of new technologies. The ICT tools have permitted quick transfer of new knowledge from laboratory to farmers. Typical applications include application in crop growth modelling, crop-based decision support systems, Geographic Information Systems (GIS) and Operation Processing Systems (OPS) applications in natural resource management, web-based database on pest informatics, soil information system, consortium for e-resources in agriculture, etc. Lab-to-Field concept has got a boost with the help of ICT (*De &*

Jirli, 2010). There have been some initiatives in India, where Information Technology is used for agriculture development such as Gyandoot project (Madhya Pradesh), Warna wired village project (Maharashtra) iKissan Project by Nagarjuna Group of Companies. some exclusive agricultural portals are also available such as Haritgyan.com, Krishiworld.net, TOEHOLDINDIA.com, Agriwatch.com, ITCs Soyachoupal.com, Aquachoupal.com, Plantersnet.com, etc. There are several Ministries/ Departments in Government dealing with Agricultural Marketing. The Government digital initiatives include AGRISNET, AGMARKNET, DACNET, APHNET, FishNet, HortNet, SeedNet, FerNet, ARISNET etc with their independent websites (*Rai et.al 2014*). So, Information and Communication Technology (ICT) is becoming part and parcel of national development strategies across the globe. Agricultural research in India is carried out predominantly by the research scientists working in ICAR and its institutes, SAU's and KVK's

and DAATTC's under them for technology generation and technology transfer, as the research done in lab should be taken to field (*Apoorva et.al 2022*). In the state of Telangana, ICT initiatives like e-choupal, i-kissan, e-sagu, kissan call centre are disseminating their services to a larger extent and doing the needful for farmers development. e-Readiness (electronic readiness) assesses the quality of a country's ICT infrastructure and the ability of its consumers, businesses and governments to use ICT to their benefit. *Jirli et.al (2016)* made an effort to define e-Readiness at various levels. "*Individual e-Readiness*" is the degree to which an individual is able to access and use the ICT tools and has the necessary skills to get himself/ herself updated with the technological developments. *"Institutional e-Readiness"* is the degree to which an institution possesses infrastructure, network accessibility, policy support and affordability to acquire and effectively utilize ICTs. Also, it should possess sufficient skilled manpower to efficiently and effectively utilize the available ICT infrastructure. *"National e-Readiness"* is the degree to which a nation possesses necessary infrastructure, internetwork accessibility, affordability, policy support and the human resource with necessary skills to acquire, access, utilize ICTs. The indicators identified were ICT Infrastructure, ICT accessibility, ICT affordability, ICT skills and Policy interventions regarding adoption of ICTs (*Rai et.al, 2014*).

The study adopted the indicators and an effort has been made to design a reliable and valid scale to measure the e-readiness of extension service providers of various Agricultural Research and Development Institutes in Telangana.

METHODOLOGY

For the construction of the tool, the summated rating method suggested by *Likert (1932), Edwards (1957),* and *Patil et al. (1996)* were followed. The scale was developed by following these steps:

Collection and editing of statements: As the first step in developing e-Readiness scale, Collection of the set of items related to e-Readiness of extension service providers was done from the various literature available on the internet, books, magazines, journals, newspaper articles, etc. by holding discussions with the supervisor and also with consultation with subject experts. A tentative list was drafted in the beginning which is of 55 statements keeping in view the applicability or item suited to the area of the study and

enlisted after consulting with the researchers, extension experts. Collected statements were cautiously edited by 14 informal criteria, suggested by (*Edwards,1957*). Maximum care was taken in editing the statements so that it could measure what is intended. The statements are framed in such a way that it expresses positive or negative attitude. For the sake of easiness in the application of the scale, the identified statements were grouped in five dimensions such as ICT infrastructure, ICT accessibility, ICT affordability, ICT skill and Policy making.

Experts' response to raw statements: The proforma containing these statements on five-point continuum ranging from Most relevant to not relevant were sent to the experts by email, google forms and printed forms. These judges were experts of the concerned subject in the universities, institutes and extension education experts working in this area. They were requested to add, modify or delete any statement which they deemed fit for the conclusion or deletion. They were also asked to examine the statements and place them on the five-point continuum indicating the degree of strength of these statements from most relevant to not relevant.

Relevancy Test: To test the relevancy of statements and screening for final selection in scale, all the enlisted statements were subjected to be a careful examination by an expert panel of judges as it may be possible that all the collected statements may not be relevant equally in measuring the e readiness of extension service providers. For this, all the 55 statements were grouped under five categories and were sent to a panel of judges. For the critical evaluation of each statement, a set of 55 statements was sent to 40 judges with necessary instructions for its relevancy measurement for the e-readiness of extension service providers. The judges were requested to give their response on a five-point continuum viz., Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree with the scores of 5, 4, 3, 2, and 1 respectively and Yes or No with 2 and 1. Out of 40 judges, 10 judges responded in the given period. In the end, the score given by 10 judges was considered for the calculation. After analysis the statements were rewritten again in light of the criticism and comments of the experts. In this way finally a total of 55 statements were retained.

After, for the computation, Content Validity Index (CVI) is used. Prior to the calculation of CVI, the

relevance rating must be recoded as 1 (relevance scale of 5,4,3) or 0 (relevance scale of 2,1).

For the calculation of CVI the following steps are used (Table 1)

Experts in agreement: Sum up the relevant rating provided by all experts for each item.

Universal Agreement (UA) : score '1' is assigned to the item that achieved 100% experts in agreement, score '0' is assigned to the statements where all the experts didn't provided relevance rating of 1.

I-CVI: the expert in agreement divided by the number of experts.

S-CVI/Ave (based on I-CVI): the average of I-CVI scores across all items. (sum of I-CVI scores)/(number of items).

S-CVI/Ave (based on proportion relevance): the average of proportion relevance scores across all experts. (sum of proportion relevance rating)/(number of experts)

S-CVI/UA: the average of UA scores across all items. (Sum of UA scores)/ (number of items).

Using these criteria, the statements were screened for their content validity satisfaction level (*Yusoff, 2019*). Accordingly, statements having CVI percent greater than 0.78 (ideal value for atleast 9 experts) were considered for final selection (Refer Table 1). With the help of this process, in the first stage, 6 statements were sorted which were further rewritten and modified as per the suggestions given by experts. Accordingly, 48 statements were selected and modified suitably and rewritten as per comments obtained by the experts.

Analysis: Item analysis is a critical step to construct valid and reliable scale by using Likert's technique. The purpose of item analysis is to select items which can able to discriminate very well between two criterions. The 48 items selected through judge's opinion were administered to a random sample of 30 extension service providers from non-sampling area. Respondents were asked to respond to the statements on five-point continuum ranging from 'Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree with the scores of 5, 4, 3, 2 and 1, respectively and Yes or No for few statements with 2 and 1 respectively. The total score for each respondent was calculated by summing up scores over all items. For item analysis, the respondents were arranged in ascending order based on e readiness score. Twenty-five percent of the respondents with the highest total scores and 25% with the lowest total scores were selected. These two groups

Table 1. The relevance ratings on the item scale by ten experts

Items	I	II	III	IV	V	VI	VII	VIII	IX	X	EA	I-CVI	UA
S1	1	1	1	1	1	1	1	1	1	1	10	1	1
S2	1	1	1	1	1	1	1	1	1	1	10	1	1
S3	1	1	1	1	1	1	1	1	1	1	10	1	1
S4	1	1	1	1	1	1	1	1	1	1	10	1	1
S5	1	1	1	1	1	1	1	1	1	1	10	1	1
S6	1	1	1	1	0	1	1	1	1	1	9	0.9	0
S7	1	1	1	1	1	1	1	1	1	1	10	1	1
S8	1	1	1	1	0	0	1	1	1	0	7	0.7	0
S9	1	1	1	1	0	1	1	1	1	0	8	0.8	0
S10	1	1	1	1	1	1	1	1	1	1	10	1	1
S11	1	1	1	1	1	1	1	1	1	1	10	1	1
S12	1	1	1	1	0	1	1	1	1	1	9	0.9	0
S13	1	1	1	1	0	1	1	1	1	1	9	0.9	0
S14	0	1	1	1	1	1	1	1	1	1	9	0.9	0
S15	0	1	1	1	1	1	1	1	1	1	9	0.9	0
S16	0	1	0	1	0	1	1	1	0	0	5	0.5	0
S17	0	1	1	1	1	1	1	1	1	1	9	0.9	0
S18	0	1	1	1	1	1	1	1	1	1	9	0.9	0
S19	0	1	1	1	0	1	1	1	1	1	8	0.8	0
S20	0	1	1	1	0	1	1	1	1	1	8	0.8	0
S21	0	1	1	1	1	1	1	1	1	1	9	0.9	0
S22	1	1	1	1	1	1	1	1	1	1	10	1	1
S23	1	1	1	1	1	1	1	1	1	1	10	1	1
S24	1	1	1	1	1	1	1	1	1	1	10	1	1
S25	1	1	1	1	1	1	1	1	1	1	10	1	1
S26	1	1	1	1	0	1	1	1	1	1	9	0.9	0
S27	1	1	1	1	1	1	1	1	1	1	10	1	1
S28	1	1	1	1	1	1	1	1	1	1	10	1	1
S29	1	1	1	1	1	1	1	1	1	1	10	1	1
S30	1	1	1	1	1	1	1	1	1	1	10	1	1
S31	1	1	1	1	1	0	1	1	1	1	9	0.9	0
S32	1	1	1	1	1	0	1	1	1	1	9	0.9	0
S33	1	1	1	1	1	0	1	1	1	1	9	0.9	0
S34	1	1	1	1	1	1	1	1	1	1	10	1	1
S35	1	1	1	1	1	1	1	1	1	1	10	1	1
S36	1	1	1	1	1	1	1	1	1	1	10	1	1
S37	1	1	1	1	0	1	1	1	1	1	9	0.9	0
S38	1	1	1	1	0	1	1	1	0	1	8	0.8	0
S39	1	1	1	1	1	1	1	1	1	1	10	1	1
S40	1	1	1	1	1	1	1	1	1	1	10	1	1
S41	1	1	1	1	1	1	1	1	1	0	9	0.9	0
S42	1	1	1	1	1	1	1	1	1	1	10	1	1
S43	1	1	1	1	1	1	1	1	1	1	10	1	1
S44	1	1	1	1	1	1	1	1	1	1	10	1	1
S45	1	1	1	1	1	1	1	1	1	1	10	1	1
S46	1	1	1	1	1	1	1	1	1	1	10	1	1
S47	1	1	1	1	1	1	1	1	1	1	10	1	1
S48	1	1	1	1	0	1	1	1	1	1	9	0.9	0
S49	1	1	1	1	1	1	1	1	1	1	10	1	1
S50	1	1	1	1	1	1	1	1	1	1	10	1	1
S51	1	1	1	1	1	1	1	1	1	1	10	1	1
S52	1	1	1	1	1	1	1	1	1	1	10	1	1
S53	1	1	1	1	1	1	1	1	1	1	10	1	1
S54	1	1	1	1	1	1	1	1	1	1	10	1	1
									S-CVI/AV		9.42		
									S-CVI/UA				0.61
PR	0.85	1.00	0.98	1.00	0.78	0.93	1.00	1.00	0.96	0.93			

Average proportion of items judged as relevance by ten experts = 0.94 pr

EA=Expert agreement

provided the criterion groups in terms of evaluating the individual statements as suggested by *Edwards (1957)*. Thus, out of 30 respondents to whom the items were administered for the item analysis, 8 extension service providers with the highest and 8 with lowest scores were used as a criterion group to evaluate the individual item. The critical ratio was calculated by t-test. The 't' value is a measure of the extent to which a given statement differentiates the high group from the low group. The 't' value was calculated by using the formula suggested by *Edwards (1957)*.

$$t = \frac{X_H - X_L}{\sqrt{\frac{S_H^2}{n_H} + \frac{S_L^2}{n_L}}}$$

Where,
X_H = the mean score on a given statement for the high group
X_L = the mean score on the same statement for the low group

S_H^2 = the variance of the distribution of responses of high group to the statement

S_L^2 = the variance of the distribution of responses of low group to the statement

n_H = number of subjects in the high group; n_L = number of subjects in the low group

Selection of Statements for final scale: After knowing "t" value for all the items, 48 statements with highest "t" value equal to or greater than 1.75 were selected (Table 2). The thumb rule of rejecting the items with 't' value less than 1.75 was followed (*Bird, 1940*).

Table 2. Statements with t value

ICT infrastructure	t value
*The institution is well equipped with personal computers (PC) for all functionaries	5.06
The institution is having broadband internet connection	0.78
*Institution is equipped with proper uninterrupted internet connectivity	5.39
*Institution has proper electricity backup throughout working hours	4.61
*Institution has access to community radio for infotainment activities	5.58
*The institution provide access to local language software in personal computers (PC) adequately	5.51
*The PCs in institution are governed by a well-furnished content management system	3.99
Institution is having own server for the internet connectivity	1.25
Institution has a T.V.	1.11
*Institution has adequate LCD projector for various activities of extension	5.37
*Institution provides e learning set up for all functionaries adequately	2.46
Institution has LAN as well as WAN connectivity	0.59
*Institution has its own website	6.59
ICT accessibility	
*The personal computers (PCs) are readily accessible to the functionaries in the institution with proper software support	7.23
*Access to internet by the functionaries has improved their work efficiency in the institution	5.58
Computers are accessible to the functionaries throughout working hours	1.21
*Each functionary is provided with computers with assumption of duty	6.52
*Functionaries can upload information by content management system	5.23
*Internet speed available >/100mbps most of the time	6.67
ICT skills	
*I have undergone adequate number of Practical trainings on ICT applications in extension services	5.23
*I regularly take-up diffusion of farm innovations/ ToT through ICTs	5.70
I am aware of e mediated extension services	1.62
*I am skilled enough in using e-mediated extension services	2.36
*Effectiveness of work has been improved because of e-mediation	6.37
*ICTs has promoted skills in extension activities	3.99
I am aware of the concept of cyber extension	0.35
*I am good at working with database/ spreadsheet/ Internet browsing/ Presentation software skills	6.06
*If any technical problem occurs in computer system I can take-up minor repairs	5.18
Quality of training programmes are improved because of e mediation	1.21
*I take the help of computers professional for preparation of presentation	4.32
*I can prepare extension teaching materials on my own using my personal computers (PC)	5.91
*With the use of ICTs, working ability and capacity of the agricultural extension personnel has been upgraded	4.98
ICT affordability	
*Our institution regularly updates personal computers (PC) of functionaries	6.67
Institution produces CDs for transfer of technology	0.97
*The institution has inverter facilities as a backup for electricity	7.02
*Provision for repair and maintenance of ICTs has been created by the institution	5
*The institution recharges the cell phone bill functionaries	4.85
*I attend training programmes for upgrading my ICT skills at regular intervals	5.70
Policy interventions regarding adoption of ICT mediated services by the institution	
*Institution is independent to develop its own website	6.06
*Institution needs permission from competent authority to launch a website	6.59
*Professionals are free to conduct experiments on innovative e-mediated extension services	4
*Institution can adopt e-mediated extension services for popularization of technologies	3.33
*Institution should have its own e- security policy	4.52
*Institution should have its own ICT policy	3.26
*Institution can hire ICT professionals for effective ICT mediated extension services	5.26
*Institution can liaison with the local and regional institutions for e mediated extension services	4.03
*Institution needs to get clearance from higher authority for ICT related issues for providing extension services	3.66
*Farmers need more support from policy makers in order to exploit ICT potential in providing extension services	5.78
*Final Statements selected for scale	

Table 3. Final Scale to measure "e-Readiness of Extension Service Providers"

ICT infrastructure	SA	A	UD	DA	SDA
The institution is well equipped with personal computers (PC) for all functionaries					
Institution is equipped with proper uninterrupted internet connectivity					
Institution has proper electricity backup throughout working hours					
Institution has access to community radio for infotainment activities					
The institution provide access to good local language software in personal computers adequately					
The PCs in institution are governed by a well furnishedcontent management system					

	Yes	No
Institution has adequate LCD projector/s for various activities of extension		
Institution provides e-learning set up for all functionaries adequately		
Institution has its own website		

ICT accessibility	SA	A	UD	DA	SDA
The personal computers (PCs) are readily accessible to the functionaries in the Institution with proper software support					
Access to internet by the functionaries has improved their work efficiency in the institution					
Each functionary is provided with computers with assumption of duty					
Functionaries can upload information by content management system					
Internet speed available >/100mbps most of the time					

ICT skills	SA	A	UD	DA	SDA
I have undergone adequate number of Practical training on ICT applications in Extension Services					
I regularly take-up diffusion of farm innovations/ ToT through ICTs					
I am skilled enough in using e-mediated extension services					
Effectiveness of work has been improved because of e- mediation					
ICTs has promoted skills in extension activities					
I am good at working with database/ spreadsheet/ Internet browsing/ Presentation software skills					
If any technical problem occurs in computer system I can take-up minor repairs					
I take the help of computers professional for preparation of presentation					
I can prepare extension teaching materials on my own using my personal computers (PC)					
With the use of ICTs, working ability and capacity of the agricultural extension personnel has been upgraded					

ICT affordability	Yes	No
Our institution regularly updates personal computers (PC) of functionaries		
The institution has inverter facilities as a backup for electricity		
Provision for repair and maintenance of ICTs has been created by the institution		
The institution recharges the cell phone bill functionaries		
I attend training programmes for upgrading my ICT skills at regular intervals		

Policy Interventions regarding adoption of ICT mediated services by the institution	SA	A	UD	DA	SDA
Institution is independent to develop its own website					
Institution needs permission from competent authority to launch a website					
Professionals are free to conduct experiments on innovative e-mediated extension services					
Institution can adopt e-mediated extension services for popularization of technologies					
Institution should have its own e- security policy					
Institution should have its own ICT policy					
Institution can hire ICT professionals for effective ICT mediated extension services					
Institution can liaison with the local and regional institutions for e mediated extension services					
Institution needs to get clearance from higher authority for ICT related issues for providing extension services					
Farmers need more support from policy makers in order to exploit ICT potential in providing extension services					

As per the thumb rule, selection of items (i.e. statements) to be retained in the scale was based on the highest discriminating values, besides eliminating those with poor discriminating ability and questionable validity. 9 statements having 't' value less than 1.75 were rejected. Thus, those 39 statements which is simple and presenting a new idea and also statement having 't' value more than 1.75, were finalized in the scale, Table 3 indicates the final statements selected.

Standardization of the scale: The validity and reliability were assured for standardization of the scale. The validity was confirmed by content validity and criterion validity.

Validity: The content validity of the scale was tested. The content validity is the representativeness or sampling adequacy of the content, the substance, the matter and the topics of a measuring instrument. As the content of the scale thoroughly covered the e readiness of extension service providers through literature review and experts' opinion, it was assumed that present scale satisfies the content validity. Thus, scale value difference for all the statements has a high discriminating value and it seems reasonable to accept the scale as a valid measurement.

Reliability: The split-half method for testing reliability was used. The scale was split into two halves on the basis of odd and even number of items and administered to 30 extension service providers. Thus, two sets of scores were obtained. The Pearson's product moment correlation coefficient was calculated. The value of correlation coefficient was 0.65 and this was further corrected by using Spearman's Brown formula and obtained the reliability coefficient of the whole set. The r-value for scale was 0.98, which was significant at 0.01 p indicating high reliability of the instrument.

CONCLUSION

The e-Readiness of extension service providers of various agricultural research and development institutes enhances efficiency of dissemination of innovations from time to time. The preference of extension professionals practicing e-Readiness in the dissemination of different types of information need to be ascertained. For this, we need reliable and valid measurement tools for correct measurements. This scale will help in the assessment of *e- Readiness of extension service* providers and how it is impacting on the transfer of technology since the validity and reliability of scale indicated the high precision and consistency of the results. It will be useful for researchers and policymakers and can also be used in other areas for study with suitable modifications.

CONFLICTS OF INTEREST

Authors declare that they have no conflict of interest.

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