RESEARCH NOTE

Standardize Index for Measuring Performance of Farmers on Mitigation and Adaptation Practices of Climate Change

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ABSTRACT

Climate change is widely acknowledged as foremost among the formidable challenges facing the world today. Due to the non-availability of a standardized measurement to measure the farmers' performance level on mitigation and adaptation practices, it was thought necessary to construct an index for the purpose. An attempt has been made to develop an index for measuring performance of farmers' on mitigation and adaption practices of climate change in hill agricultural system. Pertinent items were collected covering all aspects of mitigation and adaptation practices to climate change. After getting jury opinion on the items, thirty-nine items were selected and administered to 60 farmers. Finally, 19 items were included in the final format with the help of discrimination index (>1.75). The reliability with the help of Cronbach alpha value and the reliability coefficients value was found to be 0.84, which indicates high reliability. On administering to the final study sample, it was found that about fifty two per cent and thirty five of the farmers had low level and high level of performance of mitigation and adaptation practices.

Keywords: *Mitigation; Adaptation; Performance index; Reliability; Validity;*

Climate change is a global phenomenon, although its impacts are regional, making some regions more vulnerable than the others. Our world is characterized by fast moving geo-political and natural changes and the scenarios drawn by climate change specialists are alarming. If we want to avoid dangerous impact of cli-mate change and its drastic consequences for creatures all over the world, it is necessary to take action.

There are two distinct responses to the impacts from a changing climate. One is to take steps to slow down and moderate the pace of change. Such actions are generally called '*mitigation*' and have been designed to lessen emissions from activity generating CO_2, CH_4 and N_2O (the most common greenhouse gases) (*Smit & Pilifosova, 2003*). Another response to impacts from climate change is to focus on the ability or capacity of individuals, communities and nations to handle the impacts and/or take advantage of opportunities from altered conditions. Such actions are usually referred to as '*adaptation measures'*. 'Mitigation' and 'Adaptation measures' through the adoption of appropriate agricultural technologies are crucial for the survival amidst climate change.

India performs second best in carbon emissions level but ranks 59th in emissions development (*Burck et al., 2016*). In the agricultural sector, farmers are adopting different mitigation and adaptation practices to lessen and cope up with the impact of agricultural sector on climate change. Little research exists on performance of farmers on mitigation and adaptation practices of climate change. With this aim, the present study endeavours to develop a standardised index to measure the performance of farmers on mitigation and adaption practices of climate change.

METHODOLOGY

The study has been conducted in Meghalaya, a hill state which is highly prone to the effects of climate

change because of its geo-ecological fragility, humid monsoon climate, and socio-economic conditions. In the recent years, the state has been subject to several climate induced risks which has adversely affected the state and dynamics of natural resources. Generally, the climate is predominantly humid sub-tropical with hot, humid summers, severe monsoons and mild winters. The whole paper is presented in two parts. First part deals with construction of the performance index to measure farmers' performance level on mitigation and adaptation practices in hill agriculture and the second part deals with the measurement of the performance of farmers.

Construction of performance index to measure farmers' performance level on mitigation and adaptation practices in hill agriculture :

*Collection of items :*Items about climate change mitigation and adaptation practices were collected from relevant literature, experts, panel discussion, personal experience and pilot studies were conducted in the area of investigation. Initially, forty five items were collected. The items were selected on the basis of their apparent lack of ambiguity, simplicity and representativeness. Necessary care was taken to see that the items were based on the practices, which farmers of the hill areas performed.

Jury opinion : To assess the relative accuracy of the items, experts who are engaged in climate change research, which comprised of scientists from ICAR research complex for NEH Region, faculties from the College of P.G. Studies, CAU, Barapani, Meghalaya and extension personnel were asked to evaluate each item according to how accurate or inaccurate they thought it was and to add further suggestions. Af-ter screening, fine tuning and editing based on the opinion of the con-cerned experts; thirty-nine items were selected based on mitigation and adaptation practices of climate change in hill agriculture. The selected items were subjected to item analysis to screen some more items based on the opinion of the respondents (other than the final sample) in sample area.

Item selection : "Statement analysis is an important step in constructing a valid and reliable scale" (*Edward, 1957*). The adequacy of a test depends upon the care with which the items of the list have been chosen (*Garrett, 1981*). It is, therefore, necessary to analyse each item in order to retain only those which suit the purpose and rationale of the device being constructed. To do so, the 39 selected items were administered to the 30 farmers of East Khasi Hills district of Meghalaya who were more or less identical to the main sample but those farmers were not included in the main sample. Their reactions to each item were marked on the three point continuum ranging from "highly performed", "moderately performed" to "least performed" and the numerical values assigned were 3,2 and 1. To find out the suitability of an item, item discriminating index was calculated.

Item Discriminating Index: The most important index is the item discriminating index. This index indicates whether the items measured what is designed to measure. Discriminating value refers to making distinctions between persons having greater or lesser knowledge or skill in the area measured by the evaluator. A test item possesses adequate discriminating power when it is capable of differentiating between superior and inferior farmers. In this study, the internal criterion was used for finding out the discriminating index of an item. The score of an individual respondent on the scale was computed by summing up the weightage of individual items. The frequency distribution of scores based upon the responses concerning all the statement was obtained. According to *Edwards (1957),* 25 per cent of the highest total score and 25 per cent of the subject with the lowest total score were taken assuming that these two groups (high and low) would provide the criterion group in items of evaluating the individual statements. For evaluating the responses, the high and low groups of the individual statements, the critical ratio value was worked out by using the formula and the procedure was used given by *Edwards (1957).* The critical; ratio (t-value) for each item was worked out by the formula given by *Edwards (1957).*

$$t = \frac{X_{Hm} - X_{Lm}}{\sqrt{\frac{\sum (X_H - X_{Hm})^2 + (X_L - X_{Lm})^2}{n(n-1)}}}$$

Where,

$\sum (X_{H} - X_{Hm})^2 = \sum X^2_H - (\sum X_H)^2 / n$

$\sum (X_{L} - X_{Lm})^2 = \sum X^2_L - (\sum X_L)^2 / n$

$\sum X^2_H$ = Sum of squares of the individual scores in the high group

$\sum X^2_L$ = Sum of squares of the individual scores in the low group.

X_{Hm} = Mean score of given statement for high group.
X_{Lm} = Mean score of given statement for low group.
n = Number of respondents in each group

After analyzing the't' value, it was found that 19 items out of 39 items were found to be significant (> 1.75) at 5 per cent level of significance.

Mitigation and adaptation performance index: The present study aims at finding out the level of performance of the farmers regarding the recommended mitigation and adaptation practices in hill agricultural system. Equal weightage was given to all the items, assuming that all the items included were equally difficult to understand. The following formula was used to work out the performance index on mitigation and adaptation practices (PMA):

$$PMA = \frac{X_1 + X_2 + X_3 + \ldots\ldots\ldots\ldots + X_n}{N} \times 100$$

Where,

$X_1 + X_2 + X_3 + \ldots\ldots\ldots\ldots\ldots\ldots + X_n$ are the performed continuum value (3, 2 or 1) to the first, second, third ……. n^{th} questions and N is the maximum score possible to secure.

Reliability and Validation of index: The reliability of the index was assessed using a test of internal consistency, Cronbach's alpha. This is a split-half method of estimating reliability that offers an alternative to test-retest methods which can be impractical when assessing views about a specific event, and it is frequently employed in questionnaire development. The value of Cronbach's á = 0.84 which indicate a high internal consistency.

To determine the content validity of the index, after preparing the first draft of the index it was given to different experts working on climate change for their opinion and suggestion regarding the appropriateness and relevance of the items, type of items suitability, language clarity, ambiguity, difficulty level etc. Thus, content validity is most often determined on the basis of expert judgment. The test analyst examines carefully on outline of the content and object of the unit for which the test was designed.

Sampling method for measurement of knowledge level in arid ecosystem : The final study was conducted in West Garo Hills district of Meghalaya**.** Gambegri block of West Garo Hills district of Meghalaya was purposively selected as it was one of the most agriculturally important and vulnerable Community and Rural Development (C&RD) block to climate change. A total of 60 farmers were randomly selected for the study.

Table 1: Critical Ratio (CR) of the items

Statement	CR
Agro-ecosystem robustness	
Growing a number of different crops (intercropping)	2.09*
Use of pest and disease resistant crops	4.36*
Use of climatic resistant varieties	1.27
Use of early maturing varieties	1.09
Growing more crops per unit area	0.90
Using crop rotation practices	3.08*
Increased application of organic matter	1.77*
Increased application of herbicides and insecticides	1.45
Early planting or harvesting	1.99*
Shortening growing season	0.99
Changing time of irrigation	0.99
Changing time of fertilizer use	1.89*
Changing labour use	1.09
Practice of drip irrigation method	2.99*
Investing in water storage	1.75*
Changing water use practices to save water	0.73
Rain water harvesting	2.73*
Use of minimum tillage method	0.94
Mulching	4.73*
Using of cover crops	0.89
Planting of trees	0.91
Shifting cultivation	3.63*
Integrating of scientific and indigenous method	2.27*
Construction of poly-house or shady net	1.82*
Practice of integrated farming system	0.91
Storing of crop residues for livestock	1.18
Selection less water consuming crops	0.99
Use of windbreaks	0.91
Livelihood options	
Changing from farming to non-farming activities	1.77*
Changing from crops to livestock	0.91
Changing from livestock to crop	0.99
Relocating or reinforcing houses	1.18
Attending training on adaptation measures to climate change	1.78*
Storing of food surplus	2.82*
Migrating to other province for farming	3.73*
Migrating to other province for alternative work	2.17*
Maintaining insurance	1.82*
Taking credit from financial services	0.73
Income increment from non-farm activities	1.18

Table 2: Distribution of respondents according to their performance level

Category	No.	%
Low	31	51.7
Medium	8	13.3
High	21	35.0
Mean	78.25	
SD	13.98	

RESULTS AND DISCUSSION

Distribution of respondents according to their performance level: Respondents were classified into three categories according to their mean and standard deviation. It can be depicted from Table 2 that a majority, about fifty two per cent (51.7%) of the farmers had low level of performance of mitigation and adaptation practices. Thirty five per cent (35%) of respondents had high level of performance while only 13.30 per cent of respondents had medium level of performance of mitigation and adaptation practices in hill agricultural system. The findings drew the attention of the policy makers on immediate introduction of climate change trainings on mitigation and adaptation practices through different social institutions.

CONCLUSION

Thus, the index under study was observed highly stable or dependable for measuring performance level of farmers on mitigation and adaptation practices of climate change. Further, 19 items were finally selected by which their 't' value, was significant and a high value of Cronbach alpha of 0.84.

It was found that the index developed was valid for measuring the performance of farmers and hence it was administered for its final use. On administering to final sample, it was revealed that more than fifty percent of the farmers had low level of performance of mitigation and adaptation practices.

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