# A Scale to Measure Impact of Front Line Demonstrations on Food Security and ClimateResilience

Abstract

Krishi Vigyan Kendras (KVKs) were established to provide essential agricultural education andsupport to farmers at the grassroots level. These centers play a crucial role in disseminatingadvanced agricultural technologies and practices to improve the productivity and sustainability offarming.FrontLineDemonstrations(FLDs)playacrucialroleinagriculturalextensionprogramsof KVKs, providing a platform to demonstrate and validate new technologies, practices, andinnovationsdirectlyinfarmers'fields.Theyareanintegralpartofagriculturalextensionservices,facilitatingthesmoothandeffectivetransferofknowledgeandtechnologyfromresearchinstitutions to the farming community. The present study was conducted to develop a scale tomeasure the impact of Front Line Demonstrations on food security and climate resilience. Wecollected 107 statements, out of these 42 statements were selected through relevancy test. Out of42 statements, 28 statements were retained on the final scale. Reliability and validity of the scaleindicatesits consistencyand precision oftheresults.

Keywords: Krishi Vigyan Kendras, Innovations, Transfer of knowledge, Agricultural extension,Foodsafety, Climatechange

## 1. Introduction

"Front Line demonstrations (FLDs) is a unique approach to provide a direct interface betweenresearcherandfarmersasthescientistsaredirectlyinvolvedinplanning,executionandmonitoringof the demonstrations for the technologies developed by them and to get direct feedback from thefarmers' field" (Parmar *et al.*, 2017). This enables the scientists to improvise upon the researchprogram accordingly. Farmers can witness firsthand the benefits of adopting new technologies,suchashigh-yieldingcropvarieties,efficientirrigationmethods,orsustainablefarmingpractices.Thisleadstoincreasedcropproductivity,contributingtofoodsecurity.FLDsalsofocusonclimateresilient practices like promotion of drought-resistant crops, water-conservation techniques, andsoil management practices that help farmers adapt to changing climate conditions. By adoptingthese practices, farmers can mitigate the impact of climate change on their agricultural activities.Thus,FrontLineDemonstrationsplayapivotalroleinpromotingsustainableandclimate-resilientagricultural practices, ultimately contributing to increased food security and the ability of farmerstocopewith thechallenges posed byclimatechange.

"KVKsconductlargenumberoftechnologydemonstrationsatfarmers'fieldsfortheiradoptionbythe farmers. The KVKs conducted 12.12 lakh demonstrations on different technologies related tocrops,livestock,fisheries,farmmachineryandotherenterprisesduringthelastfiveyears".(PIB22July 2022).

“The KVKs are down-to-earth institutions committed to vocational training, transfer of latesttechnologies, on farm research and thus, serving as the light house for overall rural developmentin the district” (Rajan*et al.*, 2020). “The mandate of the KVK include technology assessment,refinementandtransfer,aimingtobridgethegapbetweenthetechnologydevelopedattheres earchinstitutions and its adoption at the field level by the farmers” (Kokate,2012). “The concept oftechnology assessment and refinement is based on participatory mode ensuring greater scientists-farmer linkage and access to agricultural technologies generated by research systems to thefarmingcommunity.Forthis,theroleofKVKsareofimmenseimportanceforoverallagriculturalandr ural developmentthrough its variousresearch and technologytransfermechanisms” (Jadhav &Pirabhu, 2019).

“EducationCommission(1964-66)oftheGovernmentofIndiarecommendedthatavigorouseffortbe made to establish specialized institutions to provide vocational education in agriculture andallied fields. The recommendation of the Commission was thoroughly discussed during 1966-72by the Ministry of Education, Ministry of Agriculture, Planning Commission, Indian Council ofAgricultural Research (ICAR) and other allied institutions. Finally, ICAR mooted the idea ofestablishing KVKs also known as Farm Science Centers as innovative institutions for impartingvocational training to practicing farmers, school dropouts and field level extension functionaries”(Jadhav &Pirabhu, 2019). “The ICAR, therefore, constituted a committee in 1973 headed by Dr.Mohan Singh Mehta to work out a detailed plan for implementing this scheme. The Committeesubmitteditsreportin1974.ThefirstKVK,onapilotbasis,wasestablishedin1974atPuduche rry(Pondicherry)undertheadministrativecontroloftheTamilNaduAgriculturalUniversity,Coimbato re. At present there are 731 KVKs across the country under different host organizations”(Rana*et al.*, 2023).

TherewasnoscaleavailabletomeasuretheimpactoftheseFrontlinedemonstrations.Hence,thepresents tudywascontemplatedtodevelopascaletomeasuretheimpactofFrontlinedemonstrationson food securityand climateresilience.

## 2. *Methodology*

The Likert’s technique was used for constructing the scale to study the impact of FLDs on foodsecurity and climate resilience. The details of the procedure followed in the construction of theLikert type scale to study the impact of FLDs on food security and climate resilience have beendiscussedas below.

Based on the review of literature, 60 and 47 statements regarding food security and climateresilience, respectively were collected and revised based on criteria suggested by Edward (1983).Afterreview42 and35itemswereretainedforscaleconstructionunder foodsecurityandclimateresilience, respectively. The 77 items under two sub-dimensions were sent to 50 experts in thefield of agricultural extension to determine its relevancy and screening for inclusion in the finalscale. “The experts were requested to give their responses on a five-point continuum i.e., highlyrelevant,relevant,undecided,lessrelevantandnotrelevantwithscores5,4,3,2and1respectively.

These experts were from the field of agricultural extension education and social science. Theywere requested to indicate their response by putting a tick mark in suitable continuum for eachitem.Theexpertswerealsorequestedtomakenecessarymodificationsandadditionsordeletions,iftheydesiredso.Outof50experts,only35expertsrespondedinaperiodoftwomonthsandtheirrelevancy score was ascertained by adding the scores and a relevancy test was worked out usingtheformula” (Ravikishoreand Seema, 2017)

$$\text{Relevancyscore} = \frac{\text{Totalscoreobtained oneach item}}{\text{MaximumPossible score}} * 100$$

Those items, which secured a relevancy score of 80 and above, were selected and were suitablymodified and rewritten as per the comments of experts. From the 77 statements, final 42 wereselectedunderthe2sub dimensions.The42statementsselectedaftertherelevancytestwerethenadministratedto 40 non-samplerespondents.

***Calculationof‘t’ Value***

The respondents were asked to indicate how much they agreed or disagreed with each statementon a five-point continuum ranging from “strongly agree” to “strongly disagree”. The scoringpattern adopted was 5 to 1 where, 5 corresponds to strongly agree, 4 corresponds to agree, 3correspondstoundecided,2 correspondstodisagreeand1corresponds tostronglydisagree.

“The perception score of the respondent was obtained by adding up the scores of all statements inthe scale. Based on the total summated scores, respondents were arranged in descending order.Respondentswithhighesttotalscores (top25%)andlowesttotalscores(bottom25%)weremadeintotwogroups.Thetwogroupsprovidedthecriteriongroupsintermsofwhichitemanalysiswascarried out as suggested by Edwards (1957). Thus, out of 40 respondents, 10 respondents withhighscoreswereconsideredashighgroupand10respondentswithlowscoreswereconsideredaslowgrouptocalculatethecriticalratioi.e.,‘t’valueforeachoftheselectedstatement.Thecriticalratio was calculated by t-test. The ‘t’ values were calculated by using the formula” suggested byEdward(1957).

“Thetvalueiscalculatedasameasureofthe extentto whichthestatementdifferentiatesbetweentherespondents of highgroupand lowgroup” (KumarandRatnakar, 2016).

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

Where,

| | | |
|---|---|---|
| t | = | the extent to witch a given statement differentiates between the high and low groups, |
| $X_H$ | = | the mean score on a given statement for the high group, |
| $X_L$ | = | the mean score on the same statement for the low group, |
| $(X_H - X_H)^2$ | = | the variance of the distribution of responses of the high group to the statement, |
| $(X_L - X_L)^2$ | = | The variance of the distribution of responses of the low group to the statement |
| n (n – 1) | = | number of subjects in low or high group; |

***Selectionofstatementsforfinalscale:***

Aftercomputingthe‘t’valueforallthestatements,28statementswith‘t’valueequaltoorgreaterthan2.55 werefinallyselected and included in thescale.

“A scale should measure what it seeks to accomplish to measure and it should be consistent in itsmeasurement.Ascalethushastobestandardizedbeforeitadministered.Thescaledevelopedwasstandardized by testing its reliability and validity. A scale is reliable when it will consistentlyproduce the same results for the same individuals on different occasions or with different sets ofequivalents. For testing the reliability, split half method was employed” (Garrett and Woodworth,1973). “Aftergettingbackthe responses,thescalewasdividedintotwohalves,alloddstatements into one half and all even statements into another. One half (one set) contains the odd numbereditems (1, 3, 5, 7 etc.) and the other half (other set) the even-numbered items (2, 4, 6, 8 etc.).Reliability coefficient (R.C) was computed using the Spearman-Brown formula" (Chandra *et* al.,2024)

$$\text{RC of test} = \frac{2^{*}\ \text{R.C of the half test, found experimentally}}{1+\ \text{R.C of the half test, found experimentally}}$$

***ResultsandDiscussion***

From the 77 statements, total of 42 statements were selected through relevancy score, based onjudges rating under the two dimensions. After computing 't' values for all the 42 statements, thestatements with 't' values more than 2.55 were selected for the final scale. Thus, out of 42statements,28statementswith't'valuemorethan2.55wereselectedinthescale.Thecorrelationofreliabilitycoefficient (r =0.702)was significantat 0.05 level of significance.

Table1.ScaledevelopedtomeasuretheimpactofFrontLineDemonstrationonfoodsecurityandclimateresilience

| Sl No. | Statements | t value |
|---|---|---|
| 1. | FLDs enhancedresourceuseefficiencybypopularizingbettervarietiesand cutting-edgetechnology. | 7.05 |
| 2. | FLDsincreasedfarmers'awarenessofvarietiessuitableforrainfed conditions | 3.24 |
| 3. | FLDsledtoanincreaseinacreageunderbiofortified varieties. | 3.43 |
| 4. | FLDsledtoanincreasein acreageunderdisease-resistantvarieties. | 2.75 |
| 5. | FLDsencouragetheactive useofbiofertilizersamongfarmers | 5.35 |
| 6. | FrequentFLDinterventionspositivelyinfluencedfarmers'willingnessto adoptimprovedvarieties | 5.96 |
| 7. | FLDsenhance awarenessofhigh-yieldingvarietiesamongfarmers. | 7.81 |
| 8. | Stronginstitutionallinkagesfacilitatedthehorizontalspreadofimproved varietiesthroughFLDs. | 3.57 |
| 9. | Short-durationvarietiesarenowbeingcultivatedasaresultofFLDs. | 4.62 |
| 10. | FLDsemphasizedtheimportanceofcropdiversification,resultinginamore resilientanddiversefoodproductionsystem. | 2.74 |
| 11. | TimelyinterventionsthroughFLDspavedthewayforvarietalreplacement. | 5.12 |
| 12. | FLDsprovided farmers with high-quality seeds, supporting better agriculturaloutcomes. | 4.02 |
| 13. | FLDsincreasedawareness aboutlocalproducts,andtheirdietaryvalueand generatedgreatermarket demandfromconsumers. | 2.72 |

| | | |
|---|---|---|
| 14. | Awell-established and coordinated research system contributed to developingimprovedvarietiessuitablefordifferentagro-climaticzones. | 3.83 |
| 15. | FLDinterventionslikenutrigardensandCFLDscanpotentiallytackle hungerandmalnutrition. | 3.34 |
| 16. | FLDsonkitchengardenshavecontributedtoincreaseddiversityinfood production. | 2.63 |
| 17. | ThroughFLDs,householdshaveacquiredtheknowledgetoprepare nutritionallybalancedmeals. | 3.85 |
| 18. | FLDsprovidefarmersaccesstothenecessaryresourcestooptimizefood production. | 5.53 |
| 19. | FLDsemphasizedtheimportanceofcropdiversification,resultinginamore resilientanddiverse foodproductionsystem. | 3.20 |
| 20. | FLDsplayedasignificantroleinaligningfarmers'practiceswitheco-friendlyapproaches. | 4.93 |
| 21. | Water-smartpracticeslikemicro-irrigationhavebeenpopularisedthrough demonstrations. | 5.12 |
| 22. | FLDsencouragednitrogen-smartpracticelikeprecisionfarming. | 2.62 |
| 23. | ThroughFLDs,Carbonsmartpracticessuchastheapplicationoforganic manureshavebecomepopularamongfarmers. | 2.91 |
| 24. | FLDscontributedtotheincreasedadoptionofcropresiduerecycling practices. | 3.62 |
| 25. | FLDspromotedthelocation-specificuseofappropriatefertilizers,reducing theenvironmentalimpact associatedwithfertilizeruse. | 2.84 |
| 26. | Energy-smartactivitiesliketheuseoffuel-efficientmachineswitnessed increasedadoptionthrough FLDs. | 2.53 |
| 27. | FLDshelpfarmersmakeinformeddecisionsbyprovidingdataonweather parameters. | 4.09 |
| 28. | FLDsfacilitatedthefine-tuningofpackageofpracticesfordiverse agroecologicalproductionsystems. | 2.94 |

***TestingtheReliabilityoftheScale:***

“A scale is reliable when it will consistently produce the same results when applied on the samesample”(Kumar,ReddyandRatnakar,2018).TheCoefficientofreliabilitywascalculatedbetween the two halves. The correlation of the reliability coefficient for both sets was worked out. Thecorrelation of reliability coefficient (r = 0.702) was significant at 0.05 level of significanceindicating the scale was highly suitable for administration to FLD farmers as the scale was stableanddependable in its measurement.

***Testingthevalidityofthescale:***

Content validity: The content validity is the representative or sampling adequacy of the content,the substance, the matter and the topics of a measuring instrument (Yibrah, Devadhi, and Nelson,2017.Thismethodwasusedinthestudytodeterminethecontentvalidityofthescale.Thevalidity of the scale was obtained through content validity by taking the judge's opinion. The statementsselected forthescale wereevaluatedindividuallyandas a wholebytheexperts.Asthecontentofthe scale was borne out by the method of collecting statements within the universe it mayreasonably be assumed that the scale of impact of FLDs on food security and climate resilience,hascontent validity.

***Administrationofthescale:***

The final scale to measure the impact of Front Line Demonstrations comprised of 28 statementsundertwodimensionsviz.foodsecurityandclimateresiliencemeasuredonafive-pointcontinuumviz., Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (DA) and Strongly Disagree(SDA)with scores of5,4, 3,2 and 1.Obtained scoreonthis scale rangesfrom 28 to140.

***Conclusion***

The final scale developed and standardized to measure the impact of Front Line Demonstrations(FLDs), was again checked by subject matter specialists in the extension department of KAU andKVKs for their relevance and coverage. The scale can be used in any geographical area withsuitable modification. Other parallel scales can also be derived and standardized from the resultsofthestudy.

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