Effectiveness of Technology Dissemination and Adoption among Farmers in Cross-River State, Nigeria

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This study compared farmers' rating of extension effectiveness in technology dissemination to the level of adoption. In conducting the study, 180 farmers participating in extension programme in Cross-River State were randomly selected through multi-stage random sampling technique. The data collected through a structured questionnaire were analyzed using the t-test of significance of difference between means to find out if farmers' mean rating of extension effectiveness differed significantly from the mean adoption score. The study found no significant difference between farmers' mean rating of extension effectiveness and the level of farmers' adoption of introduced technologies at 95% confidence level. Hence, the null hypothesis that there is no significant difference between the farmers' mean rating of extension effectiveness and their mean adoption score was accepted, while the alternative hypothesis was rejected.

Key Words: Effectiveness, Technology, Dissemination, Adoption, Cross-River State

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1. Introduction

Poor level of adoption has always been attributed to farmers' conservative attitude. The level of adoption should not only be used in measuring success or failure of extension programme because the effectiveness of extension delivery mechanism or technology dissemination is to a large extent responsible for success or failure of extension programmes. But while extension personnel assess farmers' level of adoption of introduced technologies, farmers on the other hand equally assess the effectiveness of extension personnel in technology dissemination. Agbarevo (2013) observed that an alternative means of evaluating extension programmes is measurement of the learning situations provided, which is extension delivery mechanism or effectiveness in technology dissemination. Adoption focuses on behavioural changes in the farmer, while learning situation focuses on technology dissemination mechanism. This is because if appropriate teaching/learning situations are provided, it follows that learning or positive change in behaviour of the farmer otherwise known as adoption would take place. While adoption of disseminated technologies is a good indicator of success of extension programme, poor adoption should not always be attributed to farmers' conservatism as many other factors affect adoption. In fact it has been observed (Guatam, 2009) that extension effectiveness has been largely poor in developing countries. However, an evaluation of effectiveness of technology dissemination and level of adoption would provide a better platform for assessing of farmers' predisposition to adopt or not to adopt technology other things being equal.

Extension effectiveness model as a means of evaluating extension programme was highlighted by Ajayi (2005). In this model, extension programme is evaluated on the basis of achievement of project input delivery system. The model stresses determination of effectiveness through timeliness of input supply, distribution of machinery and their availability, among other variables. Effectiveness emphasizes what extension personnel accomplish in terms of the activities it has scheduled for itself to undertake as well as how resources, such as capital, manpower, goods and services, training and technologies needed for implementation of the programme have been used (Agbarevo, 2013). Hence, extension effectiveness may be determined by the level of awareness of extension services created among the farmers, number of visits paid by the village extension worker, percentage of scheduled meetings held between farmers and extension workers, number of field

meetings held, regularity of meetings held by village extension worker, number of field days organized by village extension worker, monthly or quarterly, etc., number of demonstrations organized by the village extension worker within specified time frame (monthly, quarterly, annually), number of supervisory visits, number and regularity of research-extension linkage workshops and farmer training sessions.

It has been observed that extension delivery has recorded poor performance with regard to technology dissemination, especially in farming systems research and farmer training programmes, which have been identified as weak links in the agricultural extension delivery in Nigeria. This could be attributed in part to:

- the researchers inadequate consideration of externalities and the substantial resources that would be needed for it to keep pace with the dynamics of farming systems;
- scientist being inadequately prepared for face-to-face dialogue with farmers, and
- researchers' tendency to dominate the design, content, conduct and evaluation of the on-farm testing (Amalu; Uzzah in Agbarevo, 2013).

They further observed that faulty planning by either the research managers and/or their collaborators cause most problems that have been observed in research trials viz-a-viz technology dissemination. The problem is worsened by the fact that a large number of scientists from research institutes and universities are now working with the ADP-sponsored on-farm research trials, and several among them are eminently qualified scientists who are knowledgeable in pure basic research but are grossly inexperienced in applied or adaptive research methodologies. Furthermore, most of the new entrants have been insufficiently trained in On-Farm Adaptive Research (OFAR) methodologies, he concluded.

Poor participation of farmers in research-extension-farmer linkage activities, which is a veritable means of technology dissemination has been attributed to top-down approach in contrast to participatory approach to mainstream the resource-poor farmers into research-extension activities (Igbokwe & Enwere, 2001; Agbarevo & Obinne, 2010). Consequent upon the above, the paper hypothesizes that that there is no significant difference between the farmers' mean rating of extension effectiveness and their mean adoption score in the Cross-River State, Nigeria.

The purpose of this study was to compare farmers' rating of extension effectiveness in technology dissemination to the level of adoption. In this regard, the study hopes determine farmers' rating of effectiveness of technology dissemination and level of adoption of disseminated technologies by farmers. This provides the basis to compare level of adoption to effectiveness of technology dissemination as perceived by the farmers to determine if the mean scores differ significantly.

2. Materials and methods

The population of the study consisted of all the resource-poor farmers who participate in agricultural extension programme in Cross-River State. The sample size consisted of one hundred and eighty resource-poor men and women farmers selected from the three ADP zones in the state. Sixty farmers were selected from each zone, giving a total of 180 farmers with 10 farmers from each of the cells in the blocks selected.

To obtain a representative sample, the stratified sampling technique was used. The state was divided into three ADP zones or strata. The ADP zones were further stratified into extension blocks and finally cells. Three extension blocks were randomly selected from each of the three ADP zones using the balloting with replacement method. Hence, a total of 9 extension blocks were selected. The extension blocks were further stratified into cells, and two cells were randomly selected from each of the nine blocks giving a total of eighteen cells. Ten farmers were selected from each cell. This gave a sample size of 180 farmers.

Reliability was the test-retest technique. The extension agents and enumerators assisted the researcher in administering the copies of the questionnaire. The questionnaire was a graphic rating scale designed to measure extension effectiveness with regard to each of the effectiveness indicators to which numerical scores were assigned thus: not effective = 1, effective = 2, and very effective = 3.The data obtained were analyzed using descriptive and inferential statistics, that is, the mean and the t-test respectively. The use of mean as a descriptive statistic was obtained using a 3-point graphic rating scale, which was modified thus: > 2.50 = high (very effective), 2.0 – 2.5 = average (effective), < 2.00 = low (ineffective). A mean of 2.00 was used as cut-off point to determine effectiveness or ineffectiveness of extension personnel with respect to each of the effectiveness indicators. Thus, a 3-point graphic rating scale of 1, 2 and 3 add up to 6, which gives 2 as mean, when divided by 3. To obtain an adoption score, farmers' responses were categorized into: (a) never adopted, (b) adopted and stopped, and (c) adopted and still using innovation, to which numerical values 1, 2 and 3 were assigned respectively. The scale was modified thus: a mean > 2.5=high adoption level,2-2.5 poor adoption level, < 2.00 =very poor adoption level.

The hypothesis that there is no significant difference between the farmers' mean rating of effectiveness of technology dissemination and the mean adoption score was tested for significance using the t-test of significance of difference between means at 95% confidence level ($P \leq 0.05$).

3. Results and discussion

Results:

Table 1 shows farmers' rating of effectiveness of technology dissemination of Cross River State Agricultural Development Programme (CRADP). Farmers rated CRADP as being very effective in method demonstrations, organizing result demonstrations, organizing method/result demonstrations. The distribution of pamphlets, leaflets, posters and organization of audio-visual shows were rated ineffective with means of 1.7 and 1.9 respectively. Activities where CRADP was rated just effective included: visiting farmers (2.5), organization of field days (2.5), research – extension – farmer activities (2.5), farmer training programmes (2.2) and farmer participation in On – Farm Adaptive Research (OFAR) activities (2.1).

Table 1. Mean Rating of Effectiveness in Technology Dissemination.

Extension effectiveness Indicators	Mean
Creating awareness of extension service	2.9**
Visiting farmers	2.5*
Organizing field meeting with farmers	2.6**
Holding scheduled meetings with farmers	2.8**
Organization of field days	2.5*
Organization of method demonstrations	2.7**
Organization or results demonstrations	2.7**
Organization of method/result demonstration	2.7**
Organization of research/extension linkage workshops	2.2**
Farmer training programmes	2.1*
Participation of farmers in OFAR	2.5*
Distribution of pamphlets, leaflets, posters, etc.	1.7
Organization of audio-visual shows	1.9

* Effective
** Very Effective

Table 2 shows mean adoption scores of technologies disseminated. Technologies with high adoption scores, that is those with mean >2.5 included: SPAT - cassava based inter-planted with melon and maize (2.82), use of melon as cover crop (2.80), application of fertilizer (2.80) and herbicide use (2.6). Technologies with poor adoption level, that is, those with mean scores from 2.00 - 2.5 included : yam mini-sett technique, planting cassava, groundnut, maize as a course, planting legumes in rotation, early planting, use of yam bean for pest control, compost making, chemical pest and disease control, keeping proper farm records. Those that recorded very poor adoption, that is, technologies with mean scores <2.00 included: SPAT – yam based, crop rotation, use of Neem leaves in controlling pests and diseases. The overall means for effectiveness of technology dissemination and adoption were 2.44 and 2.61 respectively as shown in Table 3. The difference between the means was found to be insignificant at 95% confidence level($P \leq 0.05$) Hence, the null hypothesis that there is no significant difference between the farmers' mean rating of extension effectiveness and their mean adoption score was accepted, while the alternative hypothesis was rejected.

Table 2. Mean Adoption Scores of Technologies Disseminated

Technology	Adoption Mean
SPAT- Yam based	1.9
SPAT Cassava based Inter planted with melon and maize Planting cassava,	2.28*
Planting cassava, Yam mini-sett technique	2.05*
Planting cassava groundnut, maize as a course at specific spacing an time	2.3 *
Crop rotation	2.01*
Planting legumes in rotation	2.25*
Early planting	2.55**
Use of melon as cover crop	2.80**
Use of Neem leaves as mulch/surface cover	1.45
Use of yam bean for pest control	2.0*
Compost making	2.25*
Fertilizer types time and	2.80**
Methods of application herbicide use	2.60**
Chemical pest/Disease	2.45*
Keeping proper records	2.05*

* Low adoption level
** High adoption level

Table 3: Significance of Difference in Perception of Extension Effectiveness among Farmers

Variables/Group	N	$\bar{X}$	SD	Level	t-cal	t	Result
Effectiveness	180	2.44	0.364	0.05	0.68	1.96	Not Sig.
Adoption	180	2.61	0.386				

Decision: Null hypothesis accepted.

Discussion:

The poor performance of Cross River ADP in farmer-training programmes and research-extension-farmer linkage is a source for serious concern as these areas constitute strong pillars in technology dissemination. This was partly due to due to poor funding with the withdrawal of World Bank funding as well as inadequate research personnel although its performance was high in creating awareness, conducting demonstrations, organization of field days and holding meetings with farmers. Moreover, farming systems research and extension is a participatory approach to extension delivery, which is farmer centered and leads to better results,. The poor performance of the Cross-River Agricultural Development Project in Farming Systems Research and Extension (FSRE) as found by the study is supported by the findings Agbarevo (2013) who reported that, Farming Systems Research and Extension is a weak link in the agricultural extension delivery in Nigeria. Amalu, further observed that the short-comings of Farming Systems of Research and Extension (FSRE) in Nigeria are attributable in part to:

(a) the researchers' inadequate consideration of externalities and the substantial resources that would be needed for it to keep pace with the dynamics of farming systems;
(b) scientists being inadequately prepared for face-to-face dialogue with farmers, and
(c) researchers' tendency to dominate the design, content, conduct and evaluation of the on farm testing.

He further observed that faulty planning by either the research managers and/or their collaborations because most problems that have been observed in research trials. The problem is worsened by the fact that a large number of scientists from research institutes and universities are now working with the ADP-sponsored on-farm research trails. Several among them are eminently qualified scientists who are knowledgeable in pure basic research but are grossly inexperienced in applied or adaptive research methodologies. And most of the new entrants have been insufficiently trained in OFAR methodologies, he concluded.

The poor participation of farmers in on-farm adaptive trials (OFAR), which the Cross River Agricultural Development Project had earlier identified as one of the ways of actualizing its objective of incremental food production is worrisome considering the emphasis given to OFAR in Cross River ADP policy document (Lebo, 1986) as a veritable means of technology dissemination. Such poor participation of resource-poor farmers in OFAR as found by the study is equally similar to that by Swanson (1997) who observed that the poor participation of farmers in research-extension-farmer linkage activities is attributable to non-use of participatory approach to mainstream the resource-poor farmers into research-extension activities. This implies that in spite of the much emphasis on participatory approach extension delivery, its application is far-fetched. In a related study, Agbarevo (2013) reported that Farming Systems Research and Extension was a weak link in the Cross River state Agricultural Development Programme service delivery.

Furthermore, the findings of Agbarevo (2013) regarding poor inter-organizational co-ordination between research and extension which adversely affects OFAR give further support to the findings of this study, that research-extension-farmer linkage activities are poorly executed. He further observed that the frequency of contracts between researchers and extension staff was sporadic, and in some cases lacking. The poor performance of Cross-River ADP in research-extension-farmer linkage activities as well as farmer training as reported by the study is accentuated by Amalu (1998), who observed that inadequate human resources has remained a problem in agricultural research. He, therefore, advocated the training of young researchers/scientists and subject matter specialists from the Agricultural Development Projects in the general farming systems research and extension approach.

The finding of the study that farmer-training by extension staff is a weak link in the extension delivery system of Cross River ADP has been attributed to the low capacity of extension services in the agricultural development programmes, which has often been blamed on field extension agents, whose responsibility it is to educate the farmers on improved farm practices and optimal use of resources available to them (Agbarevo, 2013). Farmer training is a very important aspect of agricultural technology dissemination. Poor farmer-training programmes would invariably affect adoption of technological

recommendations packaged to farmers. This implies that adoption would have been higher if greater attention was paid to OFAR and farmer training programmes.

Apart from the high farmer/extension agent ratio, another problem responsible for poor organization of farmer-training programmes in developing countries, like Nigeria is that training activities may be beyond the capability of most field extension workers (Swanson, et al. 1984). In such a situation, they recommended that field extension staff should identify groups of farmers that need assistance and then coordinate the provision of such services by extension specialists.

Furthermore, the findings of the study that poor extension delivery service, especially with regard to farmer-training programmes and research-extension-farmer activities was largely responsible for poor adoption of recommendations is corroborated by the findings of Chinaka et al. (2005) who reported that effectiveness of extension delivery influences adoption by farmers, and that, poor extension delivery would lead to poor adoption.

Other areas of weakness in the extension delivery of Cross River ADP as found by the study were in the distribution of extension leaflets, pamphlets and posters as well in the organization of audio-visual shows. Pamphlets, leaflets and posters are very valuable training materials in technology dissemination, likewise the use of audio-visual aids. It is not surprising to observe poor performance in these areas since they form part of training programmes, which the study had earlier identified as weak links in technology dissemination.

The importance of print and audio-visual aids in extension training programmes according to Youdeowei and Kwarteng in Agbarevo (2013) include the following:

- making the learning process more interactive; guide trainees and trainers during training;
- serve as reference during and after training;
- contain useful illustrations which facilitate learning;
- make learning interesting by attracting and holding attention of trainees, especially visual aids;
- effectively convey messages which are easy to understand.

The findings of the study and the observations of Agbarevo (2013) lead to the conclusion that extension training programmes cannot be effectively conducted without printed teaching/learning aids as well as audio-visual materials. Zeitlyn (1992) further amplifies the role of training materials as appropriate media for trainers or field workers in communication in agriculture. He observed that trainers or field extension staff/workers need training materials in form of manuals, visual aids, worksheets, posters/leaflets, radio and television. Such training materials, he went further to state, should be used in the following ways in agricultural training to optimize adoption:

- manuals should be used as training guides which help extension workers to run training and use media and materials to communicate effectively;
- visual aids are needed for use in training sessions for all trainees to see and understand the message. Such message should be appropriate for the culture, context and support of the trainer worksheets, which help trainees practice new skills during training and after training sessions
- posters/leaflets, which help the trainee take the training message home to neighbours and family also remind them of what they learnt;
- radio/television, as broadcast media are used to support training by creating demand for learning the skill. It also reminds trainees to implement and follow up their training at home.

4. Conclusion and Recommendations

The finding of no significant difference between effectiveness of technology dissemination and adoption shows that adoption is a reflection of extension effectiveness in technology dissemination. In other words, if extension delivery is effective in technology dissemination, adoption is most likely to be high. Hence, effectiveness of technology dissemination could be judged by level of adoption. On the other hand, poor adoption should be attributable to poor technology dissemination and not farmers' conservatism as erroneously perceived. The study further posits that if research – extension – farmer linkage activities are strengthened through participatory approach, technology dissemination would be more effective, and adoption would be very high. This would be translated to increase in food production towards meeting the goal of Agricultural Transformation Agenda of Federal Government of Nigeria. Moreover, considering the fact most farmers are illiterate, audio and audio-visual aids would be more helpful than envisaged as posters and hand bills disseminate technology very effectively. They act as constant reminders to the farmers so long as they see them, and this would help to keep adoption high.

From the findings of the study, the following recommendations were made:

Greater attention should give to research-extension-farmer linkage activities, which constitutes a very weak link in technology dissemination if higher levels of adoption are expected.

More emphasis should be placed on use of posters and handbills for technology dissemination

by the Cross River State ADP to increase effectiveness of technology dissemination.

Farmer training programmes, especially for the contact farmers, who are leaders of the various farmer groups, and can be easily reached should be given greater attention to improve technology dissemination.

Due to the importance of agriculture in the economy of Nigeria, and the role agricultural extension is expected to play in the Agricultural Transformation Agenda of the Federal Government, agricultural extension policies and programmes should well planned and effectively executed to ensure food security.

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