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EFFECTIVENESS OF AGRICULTURAL TECHNOLOGIES DISSEMINATION AND ADOPTION AMONG RURAL FARMERS IN YENAGOA AGRICULTURAL ZONE, BAYELSA STATE, NIGERIA

[*1]Okringbo I.J. and [2]Amaegberi H.

1Department of Agricultural Economics, Extension & Rural Development,
Niger Delta University, Bayelsa State, Nigeria
[2]Department of Agricultural Economics & Extension, University of Africa, Bayelsa State, Nigeria

[*]Corresponding author's email: inemookringbo@ndu.edu.ng

ABSTRACT

This study analyzed the effectiveness of agricultural technologies dissemination and adoption among rural farmers in Ogbia Local Government Area of Bayelsa State, Nigeria. Data were collected through interview schedule and well-structured questionnaires from 90 rural farmers. Data collected were analyzed using descriptive and inferential statistics. The result showed that plantain sucker multiplication ($\bar{x}$=3.0), pro-vitamin A cassava ($\bar{x}$ = 3.4), and value addition ($\bar{x}$ = 3.0) were the various agricultural technologies development practice by research. The result showed that extension agents ($\bar{x}$ = 2.3) as well as friends and relations ($\bar{x}$=3.6) were the various channels through which the developed technologies were disseminated. The result further showed that awareness ($\bar{x}$ = 2.9), interest ($\bar{x}$ = 3.1), trial ($\bar{x}$ = 3.1), evaluation ($\bar{x}$ = 3.0), and adoption ($\bar{x}$ = 3.1) were the various categories of adoption of agricultural technologies disseminated. The study also showed that complexity of technology ($\bar{x}$ = 2.8), triability of technology ($\bar{x}$ = 3.5), relative advantage and cost ($\bar{x}$ = 3.6) were the various attributes that influenced the adoption of agricultural technologies by rural farmers. The regression result indicated that the coefficient of agricultural innovations (0.222) was positive and statistically significant at 1%. The ANOVA result showed that F-test (4.074) was greater than the tabulated F-value (3.04) at 5% level of significance. It was concluded that extension agents, contact farms, space and print, friends and relations were the various channels through which agricultural extension technologies were disseminated. Hence, the study recommended that the development of new agricultural technologies must be pursued with vigorous provision of extension services to farmers.

Key words: agriculture, technologies, dissemination, adoption, rural farmers

INTRODUCTION

Scientific and technological progress has long helped farmers in the industrialized world by increasing agriculture output. However, it is also documented that in Nigeria, despite the adoption of improved varieties and their ensuing positive impact on productivity, farmer poverty is still a serious problem and that the living conditions in rural areas are still appalling (Awotide *et al.,* 2012; Adzenga and Dalap, 2023). Smallholder farmers in Nigeria who provide a sizable portion of the nation's food supply have not yet reaped the same advantages from technical developments. Many contemporary instruments necessary for success are not available to them, including crop management tools, contemporary irrigation techniques, fertilizers, post-harvest loss remedies, improved seeds and other planting materials, access to information, and extension services (Adzenga and Dalap, 2023).

Rehman *et al.* (2016) identified availability and affordability of technologies as the first of two key factors that influence the adoption of agricultural technology in developing nations. The farmers' anticipation that adoption will continue to be profitable is the second. Both of these factors impact how risk-averse farmers are. The farmer's expectations are, however, driven by a number of factors. The adoption of sustainable farm technologies is being made easier by a number of physical and socio-economic factors, including research and development initiatives, the trend toward better farmer education and training, the shift in the focus of advice, quicker and cheaper ways of disseminating and sharing information, the availability of financial resources, pressure from consumers, non-governmental organizations, the media, and the general public (Rehman *et al.,* 2016).

The level of technology adoption among farmers is also impacted by a number of policies, such as those pertaining to agriculture, the environment, and research and development, which offer a combination of incentives and disincentives for technology adoption (Umar, 2022). Due to their reliance on traditional knowledge that they perceive

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to be profitable, some of these farmers also struggle to absorb the information currently in circulation (De Macedo and Chino, 2002; Umar, 2022).

The objectives of this study included: to identify the various agricultural technologies disseminated by research institutes; ascertain the various channels through which the technologies were disseminated; examine the effectiveness of agricultural technology disseminated among farmers; examine the various categories of adoption of agricultural technology disseminated among farmers; and identify the various attributes that can influence the adoption of agricultural technologies by rural farmers. The study hypothesized that income of rural farmers has no significant influence on agricultural technologies developed by research.

METHODOLOGY

This study was conducted in Yenagoa Local Government Area (LGA) of Bayelsa State, Nigeria. The study area lies along latitudes 4º 55′ 36.30″ N and longitudes 6º 16′ 3.50″ E. Yenagoa LGA had a population of 267,400 by 1996 estimate with a projected population of 352,285 in 2022 based growth rate of 0.1% by Nigeria Population Commission. The state shares common boundary with Mbiama communities of Rivers State on the North East, Kolokuma/Opokuma LGA on the North West, Ogbia LGA on the South East, and southern Ijaw on the South West. A total of 10 rural farmers were randomly selected from nine communities, making a total of 90 rural farmers. Data collected through structured questionnaire were analyzed with descriptive statistics such as mean, while ordinary multiple regression and analysis of variance were used to test the hypotheses. The questionnaire was a 4-point rating scale of strongly agree (SA), agree (*A*), disagree (*D*), and strongly disagree (SD) to which numerical values 4, 3, 2 and 1 were assigned, respectively. The scores summed up to 10 and gave a mean of 2.50 when divided by four. Hence, the cut-off point of 2.55 as the upper limit was used to determine a positive response (i.e., 2.50 + 0.005 = 2.55).

Model Specification

The ordinary least square multiple regression model is specified thus:

$$Yi = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + e_i \;..\; (1);$$

where Y is rural farmer's income (₦), X is agricultural technologies developed by research (measured on a 4-point rating scale), X_1 is cocoyam technology, X_2 is yam mini-sett technology, X_3 is plantain sucker multiplication, X_4 is pro-vitamin A cassava production technology, X_5 is snail farming, X_6 is oil palm processing, X_7 is fisheries processing, X_8 is livestock production, X_9 is advisory service on marketing produce, X_{10} is value addition, and e_i is error term.

$$F\text{-stat} = \frac{\text{Between group mean squares (BGMS)}}{\text{Within group mean squares (WGMS)}}$$

Decision rule was with a computed value of *F*-test (ANOVA) greater than the tabulated *F*-value of at 5% level of significance; we rejected null hypothesis (H_O) and accepted the alternative.

RESULTS AND DISCUSSION

Various Agricultural Technologies Developed by Research

Results in Table 1 show the various technologies developed by research institutes including cocoyam ($\bar{x}$ = 2.4), yam minisett ($\bar{x}$ = 2.0), plantain sucker multiplication ($\bar{x}$ = 3.0), pro-vitamin A cassava ($\bar{x}$ = 3.4), oil palm processing ($\bar{x}$ = 3.0), advisory service on marketing produce ($\bar{x}$ = 3.3), and value addition ($\bar{x}$ = 3.0) were ranked 1st, 2nd, 3rd, and 4th, respectively. This showed that a higher percentage of farmers identified the pro-vitamin A cassava as the most common technology developed by research and new to the farming system. This finding buttressed the studies of Ogunsumi (2011) and Ishiak *et al.* (2021), who reported that favorable attitude of farmers towards any agricultural practice or innovation is an indication of improved yield and agricultural production.

Channels through Which the Technologies Developed by Research Were Disseminated

Results in Table 2 show channels through which technologies developed were disseminated; extension agents ($\bar{x}$ = 2.3), contact farms ($\bar{x}$ = 2.4), space and print ($\bar{x}$ = 2.2) and friends and relations ($\bar{x}$ = 3.6) were ranked 3rd, 2nd, 4th, and 1st, respectively. This implied that technologies developed by research were mostly disseminated through family and friends as it had the highest percentage in the study area. This finding is in line with that by Loevinsohn *et al.* (2013), who reported

Table 1: Various agricultural technologies developed by research

Variables	SA	*A*	*D*	SD	Sum	Mean	Rank
Cocoyam technology	7.00	29.00	47.00	7.00	216.00	2.40	5th
Yam minisett technology	9.00	17.00	36.00	26.00	185.00	2.00	6th
Plantain sucker multiplication	21.00	55.00	10.00	4.00	273.00	3.00	3rd
Pro-vitamin A cassava production	44.00	42.00	3.00	1.00	309.00	3.40	2nd
Oil palm processing	21.00	56.00	7.00	6.00	272.00	3.00	3rd
Advisory service on marketing produce	16.00	50.00	21.00	3.00	259.00	2.80	4th
Value addition	47.00	32.00	7.00	4.00	302.00	3.60	1st
Decision cut-off point						2.50	

Field Survey (2023). SA - strongly agree, *A* - agree, *D* - disagree, SD - strongly disagree

Table 2: Various channels through which the technologies developed by research are disseminated

Variables	SA	*A*	*D*	SD	Sum	Mean	Rank
Extension agents	5.00	31.00	48.00	4.00	213.00	2.30	3rd
Contact farms	4.00	33.00	48.00	5.00	216.00	2.40	2nd
Space and print media	6.00	22.00	52.00	10.00	204.00	2.20	4th
Friends and relatives	59.00	28.00	2.00	1.00	325.00	3.60	1st
Decision cut-off point						2.50	

Field Survey (2023). SA - strongly agree, *A* - agree, *D* - disagree, SD - strongly disagree

that farmer's decisions about whether and how to adopt new technology were conditioned by the dynamic interaction between characteristics of the technology and the array of conditions and circumstances. Farmers in Nigeria tend to rely on interpersonal networks, including family and friends, for information on agricultural technologies. Family and friends serve as valuable channels for the exchange of information on new technologies and their benefits. They provide practical and firsthand knowledge on the performance, suitability, and profitability of various agricultural technologies.

Effectiveness of Agricultural Technologies Disseminated Among Farmers

The result in Table 3 shows various media through which the effect of a technology is determined either annually, quarterly, monthly, or if there was no visit at all. The table clearly showed the various mean values: adaptive research trials were located in farmers' field ($\bar{x}$ = 1.7), technology development activities kept pace with correct field practice ($\bar{x}$ = 1.8), extension agents participated in field research trial ($\bar{x}$ = 1.8), result demonstration ($\bar{x}$ = 1.7), method demonstration ($\bar{x}$ = 2.1), small plots adaption techniques ($\bar{x}$ = 2.2), farmers' field school ($\bar{x}$ = 2.0). This implied clearly that the small plots adaption techniques and farmers field school were effective agricultural technologies disseminated among farmers, while adaptive research trials, technology development activities, and extension agents participation in field research trial were not effective based on decision cut-off point.

Various Categories of Adoption of Agricultural Technologies Disseminated among Farmers

Table 4 shows the various categories of adoption of agricultural science teachers of rural farmer in the study area. The result showed that awareness ($\bar{x}$ = 2.9), interest ($\bar{x}$ = 3.1), trial ($\bar{x}$ = 3.1), evaluation ($\bar{x}$ = 3.0), and adoption ($\bar{x}$=3.1) were the various categories of adoption of agricultural technologies disseminated among farmers. This implied that rural farmers were properly educated on various categories of adoption. This finding is in line with the submission of Federal Ministry of Agriculture and Rural Development (2022) that agricultural technologies dissemination fostered knowledge creation and transfer, particularly to farmers and strengthened agricultural research and training.

Various Attributes that can Influence the Adoption of Agricultural Technologies by Rural Farmers

Table 5 shows the various attributes that could influence adoption of technologies by farmers in the study area, including compatibility of technology ($\bar{x}$ = 2.3), complexity of technology ($\bar{x}$ = 2.8), triability of technology ($\bar{x}$ = 3.5), and relative advantage and cost ($\bar{x}$ = 3.6). This clearly implied that respondents agreed more strongly to the fact that adoption of technology was mostly as a result of its advantage and cost (like quick maturity of the crop). This is in line with the report of John *et al*. (2022) that factors like education and extension agent visits had influence on the transfer of improved technologies to farmers.

Table 3: Effectiveness of agricultural technology disseminated among farmers

Variables	*M*	*Q*	AN	NV	Sum	Mean	Rank
Adaptive research trials are located in farmers field	8.00	9.00	17.00	56.00	149.00	1.70	5th
Technology development activities keep pace with correct field practice	8.00	10.00	25.00	47.00	159.00	1.80	4th
Extension agents participate in field research trial	7.00	8.00	25.00	60.00	162.00	1.80	4th
Result demonstration	7.00	8.00	25.00	50.00	152.00	1.70	5th
Method demonstration	12.00	8.00	51.00	19.00	193.00	2.10	2nd
Small plots adaption techniques	6.00	13.00	68.00	3.00	202.00	2.20	1st
Farmers field school	6.00	13.00	50.00	21.00	184.00	2.00	3rd
Decision cut-off point						2.50	

Field Survey (2023). *M* - monthly, *Q* - quarterly, AN - annually, NV - never visited

Table 4: Various categories of adoption of agricultural technology disseminated among farmers

Variables	SA	*A*	*D*	SD	Sum	Mean	Rank
Aware	21.00	47.00	14.00	8.00	261.00	2.90	4th
Interest	20.00	63.00	7.00	0.00	283.00	3.10	2nd
Trial	42.00	42.00	6.00	0.00	306.00	3.40	1st
Evaluation	24.00	54.00	6.00	2.00	272.00	3.00	3rd
Adoption	26.00	51.00	8.00	5/00	278.00	3.10	2nd
Decision cut-off point						2.50	

Field Survey (2023). SA - strongly agree, *A* - agree, *D* - disagree, SD - strongly disagree

Table 5: Various attributes that influence the adoption of agricultural technologies by rural farmers

Variables	SA	*A*	*D*	SD	Sum	Mean	Rank
Compatibility of the technology	17.00	38.00	12.00	2.00	208.00	2.30	4th
Complexity of the technology	13.00	53.00	19.00	5.00	254.00	2.80	3rd
Triability of the technology	52.00	36.00	2.00	0.00	320.00	3.50	2nd
Observation of the technology	52.00	33.00	2.00	3.00	314.00	3.50	2nd
Relative advantage and the cost of the technology	62.00	20.00	4.00	4.00	320.00	3.60	1st
Decision cut-off point						2.50	

Field Survey (2023). SA - strongly agree, *A* - agree, *D* - disagree, SD - strongly disagree

Effect of Rural Farmers' Income on Agricultural Technologies Developed by Research

Results in Table 6 show that four functional forms—linear, exponential, semi-log and double-log were conducted for choice of a lead equation. Based on the magnitude of the coefficient of simple determinations (r^2), the significance of the regression coefficient, and the sign of the significant variable as they conform to *a priori* expectations as well as the significant of the entire model as shown by the *F*-statistics, the linear model was chosen as the lead equation. The value of the coefficient of multiple determinations (r^2) was 0.322, implying that about 32.2% of the variations in the level of farmers' income in the study area was explained by the explanatory variable included in the model that is agricultural technologies developed by research institutes and adopted by farmers.

The regression result indicated that the coefficient of agricultural innovations (0.222) was positive and statistically significant at 1% level of significance. This implied that development of agricultural technologies and innovations by research institutes and the adoption of these innovations by farmers were positively related to changes in the income level of farmers. Thus, as new technologies in agriculture were created, farming systems improved, increasing livelihood activities because of increased income of farmers. It has been established that poverty in Nigeria has a strong linkage with the nature of the technology, how it functions, and how well it can be utilized by uneducated farmers in this category. Most technologies failed because they were difficult and complex for farmers to handle, not because they were bad in and of themselves (Oyetoro, 2022). The enhancement of local crop production can be achieved by improving capacity in terms of enhancing access to improved innovations on farming systems (Ejiogu-Okereke *et al.,* 2016).

Level of Adoption of Agricultural Technologies Disseminated Among Rural Farmers in the Study Area

The ANOVA result showed that *F*-test (4.074) was significant at $p < 0.05$, and greater than the tabulated *F*-value of 3.04 at $p < 0.05$ which suggests that the null hypothesis was rejected and the alternative accepted. Hence, there was significant difference in the level of adoption of agricultural technologies disseminated among rural farmers in the study area.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings, it is concluded that agricultural technology dissemination and adoption among rural farmers was effective. Evidently, adoption was mostly from friends and relatives. Farmers identified various attributes that influenced the adoption of technologies such as compatibility of technology, complexity, triability and relative advantage, and cost of the technology. Significant differences existed on the level of adoption of agricultural technologies disseminated among rural farmers. Based on the findings of this study, the following recommendations were made:

Table 6: Effect of rural farmers' income on agricultural technologies disseminated by research

Variables	Linear^{+}	Exponential	Semi-log	Double log
Constant	–1.575 (–2.334)**	–1.117 (–3.476)***	–9.41 (–4.929)***	–3.767 (–4.144)***
Agricultural technologies disseminated	0.222 (6.466)***	0.076 (4.666)***	9.467 (6.374)***	3.219 (4.553)***
r^2	0.322	0.198	0.316	0.191
Adjusted r^2	0.314	0.189	0.308	0.181
F-statistic	41.815***	21.770***	40.629***	20.732***

***, ** - statistically significant at 1 and 5% levels of significance, respectively. Figures in parentheses are *t*-values,
$^{+}$ - lead equation, r^2 - coefficient of determinations

Table 7: Level of adoption of agricultural technologies disseminated among rural farmers

	Sum of squares	df	Mean squares	*F*-statistics	*F*-tabulated	*p*-value
Between groups	15.289	8	1.911	4.074***	3.04	0.000
Within groups	38.000	81	0.469			

*** - significant at 1% level of significance, df - degree of freedom

i. There is a need for the government to fund extension programs and ensure that extension agents carry out their duties effectively.
ii. The development of new agricultural technologies must be pursued with vigorous provision of extension services to farmers by Government.
iii. Collaboration between farmers, Government and non-governmental organizations (NGOs) on technology transfer through private and public extension agents should be encouraged through farmers' formidable cooperative membership.

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