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The Effects of Socioeconomic and Technological Characteristics on Discontinuance of Adoption of Improved Rice Production Technologies in Nasarawa and Plateau States, Nigeria

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Abstract **– The study analyzed the effects of socioeconomic and technological characteristics on discontinuance of improved rice production technologies in Nasarawa and Plateau States, Nigeria. A multistage sampling technique was employed to select 310 respondents for the study. Data were collected from primary source, using a structured questionnaire. The data collected were analyzed using descriptive statistics and logit regression. The result shows that most of (82.58%) of the respondents were male with a mean age of 45.10 years and were mostly married (80.32%), most (79.03%) of the respondents had primary education. Majority 60.56 percent and 66.15 percent of rice farmers in the area had family size of more than six persons and mean rice income of above ₦198,000 and Most 88.89 percent and 93.85 percent of the respondents belonged to farmers associations or cooperative society. It was found that 84.19 percent of rice farmers in Nasarawa and Plateau States had high levels of discontinuances. The coefficient of farm size (-1.031), household (-.186), rice income (.001), cost of technology (.561) and relative advantage (-.546) were found to significantly affect rice farmers decision to discontinued the use of improved technologies in the study area. It was recommended that the socio-cultural variables of rice farmers should be seriously considered by researchers and extension administrators before formulating, packaging and disseminating improved technologies so as to avoid discontinuance associated with complexity and socioeconomic barriers.**

Keywords **– Effects, Discontinuance, Rice, Improved, Technologies.**

I. INTRODUCTION

Rice (Oryza sativa) is the most important staple food for about half of the world human race (Oyinbo, Damis, & Rekwot, 2003; National Cereals Research Institute, (NCRI), 2004). The demand for rice in sub-Saharan Africa is growing much faster than for any other grain, with both the rich and the poor relying on it as a major source of calories (Lontau, 2003). Nigeria has a potential land area of about 6.8 hectares and only 35% of it is under cultivation with rice (Oyinbo *et al.,* 2013). The small numbers of hectares under rice cultivation is an indication that food sufficiency through rice production has not yet been realized as rice production is left in the hands of smallholders whose output is inadequate and paddy processing is substandard (Daramola, 2015).

Idiong (2005) reported that in order to increase rice production in the country, the federal government has designed policies and programmes aimed at boosting domestic production to meet domestic demand since 1989, these include amongst others, the Fadama Rice programme, the Japanese Assisted National Rice Production Project as well as the River Basin Development Rice Programme. The transfer of improved farm technologies to small scale farmers is vital towards increasing agricultural production. Discontinuance is a decision to reject an innovation after having previously adopted it. According to Rogers (2003), there are two main types of discontinuances namely, replacement and disenchantment. Replacement discontinuance is a decision to reject an idea in order to adopt a better idea that supersedes it. Disenchantment discontinuance on the other hand is a decision to reject an idea as a result of dissatisfaction with its performance. A number of improved rice

production technologies were developed and extended to farmers to increase rice production; these improved technologies include improved seeds, agrochemicals, tractors and fertilizers. However, contemporary observations showed that, while many have adopted the improved technologies with excitement, there are also glaring evidences of discontinuances of such adoptions as reported by PADP (2014).

The test hypotheses were 1.That rice farmers' socioeconomic characteristics have no significant effect on the level of discontinuance of improved rice production technologies. 2. That technological characteristics have no significant effect on the level of discontinuance of improved rice production technologies.

II. METHODOLOGY

The study was conducted in Nasarawa and Plateau States. Nasarawa State lies between latitudes 7° and 9°N and longitude7° and 10° E. It has a mean temperature of 60°F and 80°F with an annual rainfall ranging between 131.73cm and 145cm. Rainy season is from April to October, it has a projected population of 2.9 million people (National Population Commission, (NPC), 2018). Plateau State is located in the North Central of Nigeria. The State has projected human population of 4.1 million people (2018 projected figure at 3% exponential growth rate) (NPC, 2018), with land area of about 26,899 km^2. It is located between latitude 9°10'N and longitude 9°45'E. It has a temperate climate type with an average temperature of between 18°C and 22°C. The annual rainfall varies from 1317.50 mm to 1460 mm. Agriculture is the major economic activity in Plateau State. (Plateau State Government, 2017).

Population of the study consisted of all rice farmers in Nasarawa and Plateau States. A total of three hundred and ten respondents were selected using a multistage sampling technique. Firstly, two States were purposively selected because of their contiguous nature. Secondly, each of these two States were stratified into southern, central and western for Nasarawa State (NADP, 2012) and northern, central and southern for Plateau State, (PADP, 2014) but only the southern zones were considered for this study because of their level of rice production. Thirdly, two blocks each were purposively selected based on their comparative advantage in rice production (NADP, 2012; PADP, 2014). Fourthly, three cells each were purposively selected. Using a proportional allocation of 10%, a total sample size of three hundred and ten respondents were selected.

Data were collected from primary sources with the use of a structured questionnaire. Data for this study were analyzed using descriptive statistics and Logit Regression analysis.

III. RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents

The overall result in Table 1 shows that 40 percent of the respondents were aged 41-50 years whereas 25.48 percent were of the age bracket of 31-40 years. The mean age of rice farmers in the study area was 45.10 years. About forty percent (38.33%) of the respondents in Nasarawa State were aged 41-50 years as against 34.44 percent where of the age bracket of 51-60 years, with mean age of 45.10 years. Whereas in Plateau State a higher percentage (42.31%) were aged 41-50 years, followed by those (38.08%) in the age bracket of 31-40 years, the mean age was 44.94 years. The result indicates that there were more young rice farmers in Plateau State than Nasarawa State, which also means that rice farmers in the study area are mature, active and of productive age. The result is in consonance with that of Bello, Salau and Ezra (2012) who reported that rice farmers in Nasarawa State were of active age of 45 years.

The pooled result (Table 1) shows that 82.5 percent of respondents in the two States were male and 17.42 percent were female. In Nasarawa State majority (83.89%) of respondents were male farmers and only (16.11%) were female. Similarly, in Plateau State majority (80.77%) of the respondents were male compared to 19.23 percent that were female. The result shows that rice production in the study area was dominated by male farmers. Although PADP, (2014) and NADP, (2012) showed abundant evidence of female farmers' participation in agricultural activities in the study area, but the result indicates that only few took part in rice farming, this could be attributed to their involvement in domestic work and poor access to the means of production compared to their male counterparts. The result is similar to that of Nwalieji, Madukwe, Agwu and Umerah (2014) who found that rice production in Anambra and Ebonyi states was dominated by male.

Analysis of marital status of the respondents in the study area indicates that most (80.32%) of rice farmers in the study area were married and 9.03 percent were single only 6.45 percent were widow/widower. In Nasarawa State the results revealed that majority (80.56%) were married. Similarly, the analysis in Plateau State revealed that majority (80%) were married compared to 10.77 percent that were single. The response reveals that majority of rice farmers in the study area are responsible and their family structural ties are intact. This may influence family decision on discontinuance of adoption of innovation as marriage confers some level of responsibility and commitment on individual which enables a person to take rational decisions in life. The result agrees with Nwalieji *et al*. (2014) who reported majority of rice farmers in Anambra State were married.

The pooled results (Table 1) indicated that majority (62.90%) of respondents had five to seven household members whereas 28.71 percent had two to four household members. The pooled mean was about six household members. Majority (60.56%) of respondents in Nasarawa State had five to seven household members whereas 31.67 percent had two to four household members. The mean household size was about six members. In the same vain respondents in Plateau State had majority (66.15%) of five to seven household members compared to 24.62 percent that had two to four household members. The mean household size was about six members. This result suggests that there were adequate household size and therefore enough workforces to contribute to family labour thereby reducing hired labour. The result is the same with that of Ezihe, Ajoma and Odoemenem (2016) who reported a mean household size of six persons among rice farmers in Cross River state.

Table 1 shows that that majority (75.80%) of respondents in the study area had primary education and 10.00 percent had secondary education, only 5.81 percent had no formal education. Respondents in Nasarawa State showed that Majority (74.44%) had primary education, and 9.45 percent each attended secondary and tertiary education as against 6.67 percent that had no formal education. Similarly, in Plateau State, majority (77.69%) of respondents had primary education and 10.77 percent attended secondary education compared to 4.62 percent that had no formal education. The relatively medium educational standard among rice farmers in the study area suggest that they could at least read and write. This could serve as added advantage for the respondents to quickly comprehend the features of innovations for easy adoption. The result was contrary to Bello *et al.* (2012) who found that majority of rice farmers in Nasarawa State were illiterates and had low level of formal education. This contrary result could be as result of differences in period the survey was undertaken, that is between 2012 and 2017 there was so much loss of jobs and businesses and because of that young and literate people might have taken up rice production. It could also be as a result of Central Bank of Nigeria (CBN) intervention in rice production that encouraged a lot of young and literate people to cultivate rice.

The pooled result of membership of association in the study area indicates that majority (90.99%) of the respondents were members of farmers association against 9.03 percent that do not belong to any. Majority (88.89%) of respondents in Nasarawa State belonged to farmer associations compared to only 11.11 percent that did not belong. Likewise in Plateau State the results indicated that majority (93.85%) of respondents belonged to farmer associations compared to only 6.15 percent that are not members of any association. The results revealed that rice farmers in the area maintained high social profile and this is an indication of high social interaction and access to information among farmers in the study area. Bamire, Abdoulaye, Amaza, Tegbaru, Alene and Kamara (2010) reported that interaction of farmers with their fellow farmers is an avenue through which diffusion of innovation can occur.

Analysis of rice farm size in hectares revealed that above forty percent (45.16%) of the respondents in the study area had one to two hectares and 38.71 percent of the respondents had less than one hectare of rice farm. The pooled mean rice farm size was 2.10 hectares. In Nasarawa State above forty percent (43.89%) of the respondents had one to two hectares of rice farm and 43.33 percent had less than one hectare of rice farm. The mean rice farm size for Nasarawa State was 2.10 hectares. Similarly, less than fifty percent (46.92%) of the respondents in Plateau State had between one and two hectares of rice farm and 32.31 percent cultivate less than one hectare rice farm. The mean rice farm size for Plateau State was 2.06 hectares. This means that rice farm size holding in the study area was low which confirms that rice farmers in the study area were small scale farmers and subsistence in nature. A small scale farmer lacks the capacity to cultivate large scale farms that will improve his profitability which will enable him purchase improved technologies. The result aggress with that of Kagbu, Omokere and Akpoko (2016) who reported that rice farmers in Nasarawa State cultivate an average of 1.0 to 2.0 hectares.

Table 1 shows that a little above forty percent (42.58%) of the respondents in study area realized less than ₦100,000 income from rice farm compared to 32.26 percent that realized between ₦201,000 and ₦300,000. The pooled mean rice income was ₦198,374. In Nasarawa State more than forty percent (41.11%) of the respondents realized less than ₦100,000 per annum from rice farm compared to 36.67 percent that realized between ₦201,000 and ₦300,000. The mean income of Nasarawa State rice farmers was ₦195,600. In the same vain about 44.62 percent in Plateau State earned less than ₦100,000 income from rice farm compared to 26.15 percent that realized between ₦201,000 and ₦300,000. The mean rice income of Plateau State rice farmers was ₦193,669. The result shows that farmers' earnings from rice were low and it depicts the characteristics of subsistence farming in most developing countries. The implication is that rice farmers in the area may not have enough funds to purchase the improved inputs that will enable them sustain the adoption of new improved technologies. Similar result was reported by Kagbu *et al.* (2016) who found that the annual income of rice farmers in Nasarawa State was ₦138,550.

The overall result of source of labour in Table 1 shows that majority (67.74%) of respondents used family labour and 14.52 percent used both family and hired labour for rice production in the study area. In Nasarawa State majority (72.78%) of respondents used family labour for rice production compared to 11.11 percent that used both family and hired labour**.** Likewise in Plateau State, majority (60.77%) of the respondents used family labour as against the 19.23 percent that used both family and hired labour. The implication of this result is that rice farmers relied heavily on family labour for rice production. The result is similar to that of Onah (2016) who reported that non-mechanized rice farmers in Benue State used mostly family labour for rice cultivation.

Table 1. Distribution of Socioeconomic Characteristics of Respondents (n = 310).

Socioeconomic Characteristics	Nasarawa (n = 180)		Plateau (n = 130)		Pooled (n = 310)	
	Freq. %	$\bar{X}$	Freq. %	$\bar{X}$	Freq. %	$\bar{X}$
Sex						
Male	151	83.89	105	80.77	256	82.58
Female	29	16.11	25	19.23	54	17.42
Total	180	100	130	100	310	100
Age (years)		**49.13**		**44.94**		**45.10**
≤ 20	9	5.0	1	0.77	10	3.23
21-30	2	1.10	14	10.76	16	5.16
31-40	36	01.00	43	33.08	79	25.48
41-50	69	38.33	55	42.31	124	40.00
51-60	62	34.44	17	13.08	71	23.90
> 60	2	1.11	-	-	10	3.23
Total	180	100	130	100	310	100
Marital status						
Single	14	7.78	14	10.77	28	9.03
Married	145	80.56	104	80.00	249	80.32
Divorced	10	5.56	3	2.31	13	4.19
Widow/Widower	11	6.11	9	6.92	20	6.45
Total	180	100	130	100	310	100
Educational attainment						
Non formal education	17	9.44	6	4.62	23	7.42
Primary	134	74.44	111	85.38	245	79.03
Secondary	7	5.38	20	11.11	27	8.71
Tertiary	6	4.62	9	5.0	15	4.84
Total	160	100	130	100	310	100
Household size (numbers)		**6.24**		**5.91**		**6.06**
2- 4	57	31.67	32	24.62	89	28.71
5-7	109	60.56	86	66.15	195	62.90
>7	14	7.77	12	9.23	26	8.23
Total	180	100	130	100	310	100
Farm size (ha)		**2.10**		**2.06**		**2.10**
<1	78	43.33	42	32.31	120	38.71
1-2	79	43.89	61	46.92	140	45.16
3-5	20	11.11	25	19.23	45	14.52
6-8	3	1.67	2	1.54	5	1.61
Total	180	100	130	100	310	100
Rice annual income (₦'000)		**201,772**		**193,669**		**198,374**
≤100	74	41.11	58	44.62	132	42.58
101-200	32	17.78	27	20.77	59	19.03
201-300	66	36.76	34	26.15	100	32.26
301-400	7	41.11	10	7.69	17	5.48
401-500	-	-	1	0.77	1	0.32

Socioeconomic Characteristics	Nasarawa (n = 180)		Plateau (n = 130)		Pooled (n = 310)	
	Freq. %	$\bar{X}$	Freq. %	$\bar{X}$	Freq. %	$\bar{X}$
>500	1	0.56	0	0.00	1	0.32
Total	180	100	130	100	310	100
Membership of associations						
Member	160	88.89	122	93.85	282	90.97
Non- member	20	11.11	8	6.15	28	9.03
Total	180	100	130	310	310	100
Sources of labour						
Family	131	72.78	79	60.77	210	67.74
Hired	29	16.11	26	20.00	55	17.74
Both	20	11.11	25	19.23	45	14.52
Total	180	100	130	100	310	100

Level of Discontinuance of Improved Rice Production Technologies in Nasarawa and Plateau State

Table 6 shows that 84.19 percent of rice farmers in Nasarawa and Plateau States had high levels of discontinuances, and 14.19 percent recorded moderate discontinuance compared to 1.16 percent of the rice farmers that had low level of discontinuances. The breakdown of the results indicated that higher number (77.22%) of the farmers in Nasarawa State recorded high levels of discontinuances, whereas only 20.00 percent of the respondents had moderate level of discontinuance and 2.78% of the farmers had low level of discontinuance. In Plateau State 9.85 percent of the respondents had high level of discontinuance, only 6.15 percent recorded moderate level of discontinuance, it also shows that of all the respondents in Plateau State, no single farmer recorded low level of discontinuance. The result implied high level of discontinuances by respondents in the study area and this is a dangerous threat to food insecurity and general rice production in the study area and the nation at large. The result is in consonance with Bello *et al*. (2012) who reported high level of discontinuances of improved rice production technologies among rice farmers in Nasarawa state.

Table 2. Level of discontinuance of adoption of Improved Rice Production Technologies by respondents in Nasarawa and Plateau States.

Level of Discontinuance	Nasarawa (n=180)		Plateau (n=130)		Pooled (n=310)	
	Freq.	%	Freq.	%	Freq.	%
LL	5	2.27	-	-	5	1.61
ML	36	20.00	8	6.15	44	14.19
HL	139	77.22	122	93.85	261	84.19
Total	180	100.00	130	100.00	310	100.00

Note: Low Level of Discontinuance (LD) = ≤ 30%, Moderate Level of Discontinuance (MD) = 31-60%, High Level of Discontinuance (HL) = 61-100%

Effects of Socioeconomic on the Level of Discontinuance of Adoption of Improved Rice Production Technologies in Nasarawa and Plateau States

The results in Table 2 indicated that farm size and household size were statistically significant at 5%, like wise rice income was statistically significant at 10% level of significance. This indicates that socioeconomic characteristics had significant effect on the level of rice farmers' decision to discontinue the use of improved

rice production technologies in the study area. Consequently, the null hypothesis which states that socioeconomic and technological characteristics have no significant effect on the level of discontinuance of improved technologies was rejected, and the alternate hypothesis accepted.

Specifically, the coefficient of farm size was negative and significant (-1.031). This indicates that the larger the farm size holding the less probability to discontinue improved technologies because farmers with larger farm size tend to use more of improved technologies. This is because larger farm land holders have the ability to take risk and try varieties of technologies than small farm land holders. The result agrees with Suleiman and Saeid (2011) who reported that size of cultivated land significantly affect discontinuance of sprinkler irrigation systems by rice farmers in Iran.

The coefficient of household size was also negative but significant (- .186), the result means that as the household size increases the less probability of the level of discontinuance of improved rice production technologies and a unit increase in household size will decrease the level of discontinuance by 18.6 percent. The result is similar to Ajuonu's (1997) report of significant but negative correlation between discontinuance, family size and income level of rice farmers in Benue state.

The coefficient of rice income was positive and significant (.001), implying that a unit increase in income increases the probability of discontinuance by 1.00 percent. This was contrary to *a priori* expectation, since the higher the income level the higher the capacity for adoption decisions hence any gain in income should reduce the possibility of discontinuance. It is also a probability that the farmer had diverted his income to other non-farm economic activities rather than continues use of improved technology for further productivity or income. The result agrees with that of Nguezet, Aliou, Victor and Vivian. (2011) that discovered a robust positive and significant impact of household income on continues adoption of Nerica seed variety in Nigeria.

Table 3. Logit Regression Analysis of effects of Socioeconomic and Technology Characteristics on the Level of Discontinuance of Improved Rice Production Technologies Nasarawa and Plateau States (n =310).

Variables	B	S.E	WALD	Df	Sig.	EXP (B)
Farm Size	-1.0312	.437	5.551	1	.018**	2.803
Age	-.019	.016	1.301	1	.254	.981
Education	.408	.569	.515	1	.473	1.505
Household Size	-.186	.085	4.795	1	.0293**	1.204
Rice Income	.001	.001	3.587	1	.058***	1.000
Sex	-0.91	.062	2.173	1	.140	.913
Negelkerk R^2 = -.410						
Log likelihood = -230.217						
WALD = 46.274						

**Significant at 5%, ***Significant at 10%,

Effects of Technological Characteristics on the Level of Discontinuance of Adoption of Improved Rice Production Technologies in Nasarawa and Plateau States

The result in Table 3shows that cost of technology was statistically significant at 1% level of significance whereas relative advantage was statistically significant at 5%. This indicates that technological characteristics

had significant effect on the level of rice farmers' decision to discontinue the use of improved rice production technologies in Nasarawa and Plateau States. Consequently, the null hypothesis which states that technological characteristics have no significant effect on the level of discontinuance of improved technologies was rejected, and the alternate hypothesis accepted.

The coefficient of cost of technology was positive and significant (1.561) which shows that as the cost of input increases by a unit, there is probability of discontinuance to increase by 156 percent. Any technology that is expensive is likely to be discontinued rapidly. The result is in consonance with that of Imarhiagbe, Umar and Agbonkolor (2015) who reported that factors such as inadequate capital and cost of technology had positive and significant effects on level of discontinuance of improved technologies in Edo state.

The coefficient of relative advantage was negative and significant (- .546). The result is a confirmation that technologies considered being of better relative advantage than old practice is less likely to be discontinued. Generally, innovations that are perceived as having greater relative advantage will be adopted more rapidly and the more relatively advantageous technology is, the less its rate of discontinuance (Rogers, 2003). The result is in agreement with that of Ajuonu (1997) who reported a significant and positive relationship with relative advantage, cost of technology and discontinuance of improve rice technologies by respondents in Benue state.

Table 4. Logit regression analysis of effects of Socioeconomic and Technology Characteristics on the Level of Discontinuance of Improved Rice Production Technologies Nasarawa and Plateau States (n =310).

Variables	B	S.E.	WALD	Df	Sig.	EXP (B)
Compatibility	.818	.659	1.540	1	.215	2.266
Availability	-.019	.834	.001	1	.982	.981
Cost	.561	.360	18.843	1	.000*	4.765
Complexity	.055	.223	.061	1	.804	1.057
Relative Advantage	-.546	.279	3.832	1	.050**	579
Constant	-15.650	10.287	1.567	1	.156	.000
Negelkerk R^2 = -.570						
Log likelihood = -264.328						
WALD = 44.381						

*Significant at 1%, **Significant at 5%

IV. Conclusion and Recommendations

The study concluded that, majority of rice farmers in the study area are active and mature, there were more male than female, with majority of them married and having mean household size of approximately six persons, with a reasonable income. Majority of them had primary education with small farm size holdings. Their social profile was high as majority belonged to farmers association. The study further revealed that socioeconomic and technological characteristics significantly affect discontinuance of improved rice production technologies in the study area.

Based on the conclusion of this study, the following were recommended:

The socio cultural variables of rice farmers should be seriously considered by researchers and extension administrators before formulating, packaging and disseminating improved technologies so as to avoid discontinuance associated with complexity and cultural barriers.

There should be proper education and enlightenment on the features of innovation by extension administrators to prevent misuse and subsequent discontinuance.

Government and other voluntary organizations should collaborate to fund and equip research agencies, especially those involved in rice improved technologies.

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