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Original Research Article

Factors and Constraints Associated with Adoption of Cassava Value-Added Technologies among Male and Female Farmers in Imo State, Nigeria

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Abstract

This study investigated the influence of gender in the adoption of cassava value-added technologies (CVATs) in Imo State, Nigeria. Information on socioeconomic characteristics of the respondents, level of adoption of CVATs, factors affecting decision to adopt CVATs, and problems encountered by both male and female farmers in the adoption of CVATs in the study area was solicited with a structured questionnaire designed for the purpose from 70 male and 70 female cassava farmers. Frequencies, means and percentages were used to present results of the socioeconomic profiles of the farmers while Probit regression analysis was employed to analyze factors affecting decisions to adopt cassava value-addition technologies. Results obtained indicated that most of the respondents were aged (especially females), married, received formal education, had more than 10 years of experience in cassava production, had household sizes above 4 persons, were mostly subsistent farmers that operated mostly on small sized farm lands, belonged to farmers' associations and had irregular extension contacts. The results also showed that of the eight major CVATs disseminated in the study area, the most adopted CVATs among the male cassava farmers were garri (mean = 3.68), cassava chips (mean = 3.37) and HQCF (mean = 3.34), while the most adopted among the female farmers were garri and cassava fufu flour, with mean adoption score values of 4.05 and 3.18 respectively. Factors that significantly influenced decisions to adopt CVATs by female farmers were age, household size, farm size, complexity and affordability of technology, while those that significantly influenced male cassava farmers' decisions were age, education, farm size, farm income and membership of farmers association. The main constraints encountered in the adoption of CVATs were lack of readily organized markets for the products as identified by 78.7% of the male and 82.7% of the female farmers, and lack of equipment/facilities as identified by 76.0% and 70.6% of male and females respectively. It was recommended that governments and other interested parties should ensure provision of suitable markets, equipment and facilities, and encourage and support lending institutions to provide credit facilities to rural farmers in order to improve adoption of CVATs.

Keywords: Probit regression, Cassava, Value-added technologies and Affordability of technologies

Introduction

Cassava (*Manihot esculenta* Crantz) is one of the world's most important food crops grown principally for its roots (Allem, 2002). Unfortunately, these roots are notorious for their short shelf-life due to post-harvest physiological deterioration (Yimala *et al*., 2008; Njoku, *et al*., 2014), hence they have to be processed into more stable value-added products in order to minimize post-harvest losses. These value-added products include *garri*, *fufu*, tapioca, chips, pellets, flour, alcohol, starch, HQCF and others (Adebayo, 2009).

Gender describes the culturally upheld roles and responsibilities assigned by the society on the male and female sexes and relates to the way each behaves in a given situation (Ekenta *et al*., 2013). Gender refers to social constructed role differences between men and women for the purpose of allocating powers, duties, status, responsibilities and role in any given social milieu or context (USAID, 2005). Cassava value chain reflects gender roles for men and women in value addition activities (Nweke and Tollens, 2002).

Both male and female cassava farmers/processors encounter series of problems that limit their adoption of improved CVATs. These problems, according to PIND (2011), include low consumption and poor market value of some cassava value-added products such as cassava flour, cassava chips, noodles, bread, biscuits among others, disparities between men and women's statuses in training and extension visit; poor access to productive resources such as land, cassava-processing equipment (major productive factor), control of assets (in the case of women), lack of access to productivity-raising services such as credit, cooperatives, agricultural inputs, extension and training; innovation difficulty and decision-making powers.

Many improved CVATs have been developed by both national and international research centres (Aniedu *et al*., 2012; Nwakor *et al*., 2007). These innovations have been extended to rural cassava farmers through direct training by specialists from research centres or through extension agents that have been trained by research centres. Aniedu, (2006), reported that such trainings have been conducted in Imo State since 2005, while Women in Agriculture (WIA) Unit of Imo State ADP have been conducting such training since 1991 (Odurukwe *et al*., 2006). Aniedu *et al*. (2012) reported a near average adoption of CVATs disseminated by NRCRI, Umudike, in Imo State and that lack of funds, equipment and markets were the major challenges to adoption. Anyiro and Onyemachi (2014) reported a 41% adoption rate for cassava value-added products in Abia State.

There have been studies on awareness and adoption of CVATs and products in Imo State (Odurukwe, *et al*., 2006; Aniedu *et al*., 2012) but none have looked at gender issues involved in these adoptions. Consequently there is a paucity of empirical data to support policy formulations on the subject under study. This paucity of empirical data necessitated this study on adoption level of improved CVATs by both male and female farmers/processors in Imo state, Nigeria. The specific objectives were to determine factors affecting decision to adopt CVATs by male and female cassava farmers in the study area and compare problems encountered by male and female farmers in the adoption of CVATs.

Methodology

This study was carried out in Imo State, Nigeria. The choice of the State was purposive in the sense that it is among the states in this country that benefited from the massive training and extension of technologies of new and improved food forms of root/tuber crops extended to rural farmers/women groups from 2005 to date by the National Root Crops Research Institute (NRCRI), Umudike, and the Imo State Agricultural Development Project (IMADP). The study adopted a multi-stage random sampling technique in the selection of 75 male and 75 female farmers for this study. In the first stage, two blocks were selected randomly from each of the three agricultural zones of the State, followed by a random selection of two circles from each block. The study employed primary data obtained by the use of a pre-tested and structured questionnaire to obtain data on socio-economic profiles of the respondents, membership of associations, CVATs disseminated, level of adoption of CVATs, constraints to adoption of CVATs, household consumption expenditure details among others. Descriptive statistics such as frequencies, means, tables and percentages were used to analyse and present the constraints to adoption of CVATs, while Probit regression analysis was employed to analyse factors affecting decisions to adopt CVATs.

Results and Discussion

The distribution of male and female cassava farmers who participated in cassava value-addition technologies according to their socio-economic characteristics is presented in Table 1. This result indicated a rather increasing number of the very old and aged respondents especially the female cassava farmers, while the male cassava farmers were mostly middle-aged that were within the active productive work force. Age is known to be a primary latent characteristic in adoption decisions. The ability of a farmer to bear risks and be innovative (Nwaru, 2004); and withstand the rigours, strain and stress involved in agricultural production (Onyenucheya and Ukoha, 2007) decrease with age.

Majority of the respondents (69.33% male and 76.0% female) were married and a high percentage (86.67% males and 89.33% females) received formal education ranging from primary school education to tertiary education. Acquisition of higher education by farmers is reported to enhance adoption of improved technology (Ezeh, 2007; Okoye *et al.*, 2004). The respondents were established and knowledgeable in cassava production as 77.0% of the males and 89.0% of the females had more than 10 years of experience in cassava production. Khanna (2001) also noted that higher farming experience attainable through increased years of farming leads to higher rates of adoption of new agricultural products.

Over 62% and 56% of the male and female farmers respectively had household sizes above 4 persons. Since high cost of labour is a major constraint to adoption of improved technology (Anyaegbunam *et al*, 2009), the availability of substantial family labour may reduce the cost of labour, thereby increasing the chances of the adoption of improved products.

The mean farm sizes of male and female respondents were 1.32 hectares and 1.53 hectares respectively, indicating that they were mostly subsistent farmers that operated mostly on small-sized farmlands.

Majority (72.0% and 65.33% respectively) of the male and female respondents belonged to farmers' associations. Farmers communicate most frequently and effectively with those who are most similar to them. These farmers are more likely to obtain information from and be influenced in their farming practices and adoption decision by other farmers (Murphy, 1993).

Table 1: Distribution of Male and Female Cassava Value Addition Trainees in Imo State according to socioeconomic characteristics

Socio-economic Characteristics	Male farmers		Female farmers	
	Frequency	Percentage	Frequency	Percentage
Age (years)				
30-40	23	30.67	14	18.67
41-50	24	32.00	30	40.00
51-60	19	25.33	24	32.00
Above 60	9	12.00	7	9.33
Marital status				
Single	17	22.67	8	10.67
Married	52	69.33	57	76.0
Widowed	6	8.0	16	21.33
Educational status				
No formal Education	10	13.33	8	10.67
Primary education	37	49.33	31	41.33
Secondary education	22	29.33	30	40.00
Tertiary education	6	8.0	6	8.0
Farming experience (years)				
1-10	17	22.67	8	10.67
11-20	20	26.67	22	29.33
21-30	24	32.00	27	36.0
31-40	14	18.67	18	24.0
Household size				
1-4	27	36.0	32	42.67
5-8	33	43.42	30	40.0
9-12	15	20.00	13	17.33
Farm size (hectares)				
<1	35	46.67	25	33.33
1-2.0	31	41.33	44	58.67
2.1-3.0	9	12.00	6	8.0
Membership of farmers assoc				
Yes	54	72.0	49	65.33
No	21	28.0	26	34.67
Extension contact				
Less regular contact	46	61.33	52	69.33
Regular extension contact	13	17.33	18	24.00
Very regular extension contact	16	21.33	5	6.67

Source: Field Survey data, 2014

Extension contacts with majority (61.33% and 69.33%) of the male and female farmers respectively were irregular. Since extension agents are harbingers of information about innovations, frequent contacts between them and farmers are likely to minimize doubts and enhance adoption of technologies.

The level of adoption of selected CVATs by male and female cassava farmers in Imo State, Nigeria is presented in Table 2. Overall mean adoption scores of 3.18 for males, and 3.12 for females is indicative of a high level of adoption of CVATs. Specifically, the CVATs that had adoption levels above the critical mean cut off score of 3.0 were those for making *garri* (cassava flour) (mean = 3.68), cassava chips (mean = 3.37) and HQCF (mean 3.34) among males and *garri* (mean = 4.02), and cassava *fufu* flour (mean = 3.18) among females. Male farmers may have adopted CVATs for chips and high quality cassava flour due to the need to earn cash while females rejected them due to their complexity. Akpabio *et al*. (2012) also cited complexity as a major constraint to adoption of innovation. On the other hand, the females may have adopted CVATs for *garri* and *fufu* due to their food mind-sets.

Table 2: Level of Adoption of CVATs by Male and Female Cassava Farmers in Imo State, Nigeria

CVATs	Aware	Interest	Trial	Evaluation	Accept	Total	Mean score
CFF	6(6)	42(84)	2(6)	1(4)	24(120)	220	2.99
HQCF	1(1)	5(10)	48(144)	9(36)	12(60)	251	3.34
Cassava Chips	5(5)	6(12)	39(117)	68(24)	19(95)	253	3.37
Cassava starch	36(36)	8(16)	8(24)	2(8)	21(105)	189	2.5
Garri	8(8)	12(24)	14(42)	3(12)	38(190)	267	3.68
Mean adoption Male							**3.18**
CFF	4(4)	28(56)	10(30)	16(64)	17(85)	239	3.18
HQCF	9(9)	37(74)	5(115)	9(36)	15(75)	209	2.79
Cassava Chips	7(7)	40(80)	4(12)	14(56)	10(50)	205	2.73
Cassava starch	4(4)	41(82)	5(15)	11(44)	14(70)	215	2.87
Garri	10(10)	7(14)	5(15)	-(-)	53(265)	304	4.05
Mean adoption Females							**3.12**

Cut-off score = > 3.0 = adopted; < 3.0 = did not adopt. Figures in parenthesis are the Likert scale values: Accept 5; Evaluation 4; Trial 3, Interest 2; Awareness 1, CFF (Cassava *fufu* flour), HQCF (High quality cassava flour)
Source: Field Survey, 2014

The Probit estimates of factors that influenced male farmers' decision to adopt cassava value-added innovations in the study area are presented in Table 3. The model predicted 58.57 percent of the sample correctly and posted a log likelihood and pseudo R^2 values of -43.642 and 0.147 respectively. In the model, five out of ten explanatory variables were statistically significant at given levels, and these variables were age, education, farm size, farm income and membership of farmers associations.

Coefficient of education (0.030) was positive and statistically significant at 5.0% probability level. This indicates that an increase in educational level of the male respondents increased the decision to adopt cassava value-added innovations. This result conforms to *a priori* expectations. Education has the capacity to influence people to accept new innovations and change their attitude to the desired technology (Okoye *et al.*, 2004).

The coefficient of age (-0.924) was negative and statistically significant at 10.0% probability level. This indicates that an increase in age of the respondents reduced their decision to adopt cassava value-added innovations. This result is in conformity with *a priori* expectations because age is known to be a primary latent characteristic in adoption decisions. The ability of a farmer to be innovative has been reported to decrease with age (Nwaru, 2004).

The coefficient of membership of farmers associations (-0.367) was negative and statistically significant at 5.0% *alpha* level. This implies that an increase in membership of farmers associations reduced the decision to adopt cassava value-added innovations by male farmers. This result is contrary to *a priori* expectations. It is likely that co-operative societies have not made the desired impact in the study area, and this may have accounted for the result. Murphy (1993) however stated that farmers communicate most frequently and effectively with those who are most similar to them. These farmers are more likely to obtain information from and be influenced in their farming practices and management decision by other farmers than by extension workers.

The coefficient (0.187) of farm size was positive and significant at 5.0% alpha level, which implies that the higher the farm size, the higher the tendency to adopt cassava value-added innovations. This result is in tandem with *a priori* expectations. This is because a farmer may have positive behaviour to a new technology but might have limitations due to insufficiency or non–availability of farmland (Bankole *et al.*, 2012).

The coefficient (-0.259) of farm income was negative, and was significant at 10.0% risk level, indicating that an increase in farm income of the male will reduce the decision to adopt cassava value-added innovations. This is not in line with *a priori* expectations. Agricultural produce (especially cassava tubers) are known to be highly perishable, hence most rural farmers do not get the desired reward (income) for their work as most of their produce are lost a day or two after harvest (Aniedu *et al.*, 2012). As a result of the reduction in expected farm income, adoption of value-added innovations should come into play to salvage the situation.

Table 3: Probit regression estimates of factors that influenced decision to adopt cassava value-added innovations among male cassava farmers in Imo State, Nigeria

Variable	Coefficient	Standard error	T value	P>|z|
Constant	2.055	1.898	1.08	0.279
Age	-0.924	0.470	-1.96*	0.050
Marital Status	0.060	0.178	0.34	0.736
Education status	0.030	0.013	2.34**	0.019
Household size	0.036	0.025	1.42	0.154
Farm income	-0.259	0.156	-1.66*	0.097
Farm size	0.187	0.094	2.0**	0.046
Member of farmers associations	-0.367	0.181	-2.02**	0.044
Compatibility	0.021	0.078	0.28	0.783
Complexity	0.096	0.070	1.38	0.167
Affordability	0.112	0.089	1.26	0.208
Pseudo R^2	0.147			
Log likelihood	-43.642			
Chi^2	15.07			
Cases predicted correctly	0.5857			

Source: Field survey data, 2014. **, * = variables significant at 5.0% and 10.0% alpha level

The Probit estimates of factors that influenced women farmers' decision to adopt cassava value-added innovations in Imo State, Nigeria are presented in Table 4. The model predicted 53.24 percent of the sample correctly, and posted a log likelihood and pseudo R^2 value of -18.712 and 0.284 respectively.

In the model, five out of ten explanatory variables were statistically significant at given levels and these variables were age, household size, farm size, complexity and affordability of technology. In the table (Table 4), a positive sign on the variable's coefficient indicates a higher probability to adopt cassava value-added innovations, and vice versa.

Specifically, the coefficient of household size (1.614) was positive and significant at 5.0% alpha level, and indicates that household size was important in the adoption analysis of improved cassava value-added innovations. The positive sign of the variable implies that the larger the household size, the higher the probability of adopting cassava value-added innovations by the women farmers. The availability of substantial family labour may reduce the cost of labour, thereby increasing the chances of adoption of improved innovations (Anyaegbunam *et al.*, 2009).This contradicts the findings of Omonona *et al.* (2003).

The coefficient of age (2.320) was positive and statistically significant at 5.0% probability level. This indicates that an increase in age of the respondents increased the decision to adopt cassava value-added innovations. This result is not in conformity with *a priori* expectations. This may be as a result of the total age proportion of the women respondents. Older farmers may not accept new technologies as fast as younger farmers. Age is known to be a primary latent characteristic in adoption decisions. The younger the farmers, the more active and innovative they will be. The ability of a farmer to bear risks and be innovative has been reported to decrease with age (Nwaru, 2004).

The coefficient (-0.436) of farm size was negative and significant at 10.0% alpha level, which implies that the higher the farm size, the lower the tendency to adopt cassava value-added innovations. This result is not in tandem with *a priori* expectations. This is because women cassava farmers in this area were mostly subsistence and resource-poor farmers. Bankole *et al*. (2012) opined that a farmer with a positive attitude towards an innovation or technology may be limited by insufficiency or non–availability of farmlands.

The coefficient (-0.247) of complexity of technology was negative and significant at 10.0% alpha level, indicating that a complex cassava value-added innovation will reduce the decision for its adoption especially when the innovation is not similar and does not agree with the existing culture. This is in tandem with the findings of Rogers (1995).

The coefficient of affordability (0.323) was positive and statistically significant at 10.0% alpha level thus implying that an affordable cassava value-added innovation increases women farmers' adoption decision. This is in line with *a priori* expectations, because a farmer may not readily adopt an innovation that is too expensive. Also, the higher the costs incurred in production, the lower the profit realized. This result supports the findings of Nwaru and Ekumankama (2002) that as variable cost increases, reduced inputs are used. This will in turn affect adoption of such innovation.

Table 4: Probit regression estimates of factors that influenced decision to adopt cassava value-added innovation among female cassava farmers in Imo State, Nigeria

Variable	Coefficient	Standard error	T value	P>|z|
Constant	17.583	7.914	2.22**	0.026
Age	2.320	1.086	2.14**	0.032
Marital Status	0.183	0.323	0.57	0.570
Education status	0.006	0.024	0.23	0.816
Household size	1.614	0.798	2.04	0.042
Farm income	-0.143	0.163	-0.88	0.380
Farm size	-0.436	0.253	-1.74*	0.082
Member of farmers association	-0.253	0.276	-0.83	0.408
Compatibility	0 .117	0.097	1.20	0.230
Complexity	-0.247	0.106	-2.34**	0.019
Affordability	0.323	0.203	1.60*	0.109
Pseudo R^2	0.284			
Log likelihood	-18.712			
Chi^2	14.83			
Cases predicted correctly	0.5324			

Source: Field survey data, 2014. **, * = variables significant at 5.0% and 10.0% alpha level

The problems encountered by both male and female farmers in the adoption of CVATs in Imo State, Nigeria are displayed in Table 5.

Table 5: Challenges encountered by male and female farmers in the adoption of CVATs

	Male		Female	
Constraints	**Frequency***	**Percentage**	**Frequency***	**Percentage**
Inadequate knowledge of innovation	55	73.3	48	64.0
Lack of fund	48	64.0	52	69.3
No-retraining facilities	44	58.7	47	62.7
No extension agents to answer questions	25	33.3	30	30.0
Lack of equipment/facilities	57	76.0	53	70.7
Socio – cultural restriction	29	38.67	34	45.3
Lack of market	59	78.7	62	82.7
Lack of access to credit	44	58,7	48	64.0

* Multiple responses recorded: n=7; *Multiple responses recorded: n=75
Source: Field Survey, 2014

The table shows that the main constraints encountered by both male and female farmers in the adoption of CVATs was lack of readily organized markets for the products as identified by 78.7% and 82.7% of male and women farmers respectively. Another major constraint that militated against adoption of CVATs as highlighted by 76.0% and 70.7% of the male and women farmers respectively was lack of equipment/facilities. Also, 73.3% and 64.0% of the male and women farmers respectively had the problem of inadequate knowledge of innovations. The absence of retraining facilities was identified as one of the constraints associated with adoption of cassava value-added innovations by 58.7% and 62.7% of male and

women farmers respectively. Lack of funds was also another serious constraint to adoption of CVATs. This was highlighted by 69.3% and 64.0% of the women and male farmers respectively. This is in line with the earlier report of Young (1994) that rural farmers are mostly resource-poor farmers. Hence, to enable them adopt any innovation, funds should be provided. Energy- and time-saving equipment and facilities to reduce drudgery should also be made available, otherwise, any innovation that is labour intensive may not be readily acceptable by them.

Availability of organized markets as an incentive for those who adopt these innovations is important.

Conclusion and Recommendations

The work had shown that age, household size, farm size, complexity and affordability of technologies had significant influence on female farmers' decision to adopt cassava value-added innovations, while the factors that influenced male cassava farmers' decisions to adopt cassava value-added innovations were age, education, farm size, farm income and membership of farmers association. The main constraints encountered by male farmers were inadequate knowledge of innovation, lack of funds, lack of equipment/facilities and lack of markets. Female farmers' major constraint in the adoption of CVATs were lack of readily-organized market for their products, lack of equipment and facilities, lack of funds, inadequate knowledge about innovations and lack of access to credit.

Based on the findings of the research, the following recommendations are made:

1. Markets, equipment and facilities should be put in place to ensure enhanced adoption and tangible impact of the training on the livelihoods of the people in future.
2. Government should encourage and support lending Institutions to provide credit facilities to rural farmers in order to improve adoption of CVATs.

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