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Original Article

Gender Differential in the Intensity of Adoption of Oil Palm Processing Technology in South West, Nigeria

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A B S T R A C T

This research work investigated gender differential in the intensity of adoption of processing technology in South West, Nigeria. The primary data used for this research were collected using questionnaire. Multistage sampling method was used to pick 320, comprising of 160 each of both males and females oil palm processors. The information collected were analyzed using descriptive statistics and double hurdle model. The findings of the study revealed that many of the male (89.2%) and female (89.6%) processors had knowledge of improved technology of processing oil palm. Also, 77.4% and 89.0% of the both male and female processors, respectively uses the digester, semi mechanized method of processing. The impact of extension services was not really felt in the study area as only few (4.3% and 2.2%) of the male and female processors respectively sourced their information through extension agents. The Double Hurdle Model results revealed that factors affecting adoption of the oil palm processing technology were education, access to finance, extension services, association, and experience of the female respondents while for the male respondents it includes education, extension services and experience. The outcome of the second hurdle model showed that factors affecting the intensity or adoption rate of technology among the female were extension services, level of education, access to finance and experience while for male respondents were level of education, extension services and memberships of association. Therefore, one can deduce that most of the processors in the area of study were not privileged to benefit from extension education and training. This might have negative impact in their enterprise and as well deny them in terms of information and innovative technologies to take good decisions that will increase their production level. Extension service is a paramount factor influencing adoption of technology and adoption rate of processing technology by both male and female genders. It is therefore recommended that government should provide extension services for processors in South west, Nigeria to increase level of acceptability of processing technology.

Introduction

Agriculture in a developing country is a pertinent key to development because it is an indispensable essential mean of livelihood to maintain economic growth. It is the dynamo that drives socio-economic development in most developing countries in the world (Sarku, 2016). According to Agwu *et al*. (2017), agricultural development along the value chain paves way to poverty alleviation by providing job opportunities and comfortable lives for millions of people in any nation. For instance, palm oil earned the nation about 22% of the foreign exchange till the beginning of the civil war (Onoh and Peter-Onoh, 2012). This could be achieved after processing the bunch of oil palm fruits harvested. The advantage of palm oil as a major promising product for the Nigerian agricultural sector and industry encourages the

participation of both men and women in its processing and production (Raney *et al.,* 2011).

Adoption of technology is a pertinent key to increase in productivity of both men and women in oil palm processing. Report has shown that gender participation in technology adoption in the processing of oil palm has been impeded by many constraints. Consequently, women are often confronted with using unfit processing techniques compared with their male counterparts (Unamma *et al.,* 2004). Agricultural technologies are therefore generally not gender neutral, especially regarding the adoption rate of processing technology. Thus, a gender optic is essential for assessing the effectiveness of an agricultural technology intervention (Doss, 2016).

Objectives
1. factors influencing adoption of technology of the male and female processors in the study area
2. determine and compare factors affecting the intensity of adoption of processing technology between the male and female processors in the study area.

Methodology
Double Hurdle
This was utilized to compare the factors that affect the use and the intensity of use of processing technology between both gender processors. Double hurdle model proposed by Cragg (1971) provides a flexible alternative that allows outcome to be determined by separate processes through the incorporation of a probit model in the first stage and a truncated regression model in the second stage. In addition, as the name indicates ''double hurdle'' it runs through two-stage decision processes which shows the advantage of double hurdle model over other models like tobit and multinomial logit regression models. This study reasons that the processors make two sequential decisions in relation to the processing technology, amounting, a decision on factors influencing the application of processing technology (first hurdle) and the decision on intensity of use of the processing technology (second hurdle). The consideration to use processing technology can be expressed by equation (1), which is the first hurdle-model while, the decision on intensity of how the processing technology is applied is given by equation (2) and is known as second hurdle-model.

The general model following Bruno (2013) and Ganiyu *et al.* (2018) is given as:

$$d_i^* = \alpha Z_i + u_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where

$d_1 = 1$ if $d_i^* > 0$, $d_i = 0$ if $d_i^* < 0$, $\quad u_i \sim N(0,1)$

$Y_i^* = \alpha + \beta_i X_i + v_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$

If $Y_i^* > 0$ and $d_i = 1$, then $Y_i = Y_i^*$, $Y_i = 0$ otherwise with $v_i \sim N(0, 1)$

The explanatory variables are:

X_1 = educational status,
X_2 = Type of land ownership,
X_3 = access to credit,
X_4 = access to extension service,
X_5 = distance to processing machine
X_6 = membership of association
X_7 = marital status,
X_8 = Experience
v_i = error term

The error terms u_i and v_i are assumed to be normally and independently distributed. Note that d_i is a discrete

(observed) variable measuring the possible implementation of the processing technology by processors and d_i^* is a latent (unobserved) variable for d_i. Y_i is the observed intensity of use of technology, and Y_i^* represents the latent variable for Y_i. The conclusion to use processing technology and the potency of using processing technology are influenced by variables Z_i and X_i respectively, which are allowed to overlap as also observed by Ganiyu *et al.* (2018).

Results and Discussion
Awareness of Processing Technology
Figure 1 present awareness of processing technology. From the Figure, many of the male (89.2%) and female (89.6%) processors knew about improved processing technology in oil palm processing.

Processing Techniques used by Respondents
Figure 2 showed the distribution of respondents by the processing techniques used in the area chosen for the study. The processing methods employed by the processors were categorized into three in this study: manual/traditional, semi-mechanized and mechanized. The Figure revealed that most of the male (78.5%) and female (87.9%) processors used semi mechanized method of processing, this category used one or two of the modern processing technology, the digester. Exactly 21.5% and 11.0% of the male and female processors respectively used mechanized processing technology; these categories of processors used two or more of the modern processing technology and complete the processing of palm oil using modern technology, the press to squeeze out the palm oil. However, the low percentage of processors using fully mechanized technique could probably be as a result cost of putting in place mechanized processing system or because of the perception of the processors about the quality of the palm oil produced from the press and the low impact of extension services. The result further showed that lower number (1.1%) of the female respondents in the area of study use manual/traditional processing techniques, this category of processors used no modern technology. The low number may be due to high awareness of modern processing technology which implied that awareness is an essential key to adopting technology.

Source of Information on the Technology Used
Figure 3 showed the distribution of respondents by source of information on processing method used. As revealed by the Figure most (91.4%) male and (92.9%) female processors got information from their fellow processors. Only some of the processors got information through media and extension officers in the study area. The influence of extension agents was not really felt and this may debar them from the optimum implementation of the technology available. Therefore, one can deduce that most of the processors in the area of study were not privileged to benefit from extension education and training which might have negative impact in their enterprise and as well deny them of having access to information and innovative technologies to take good decisions that will enhance their production level.
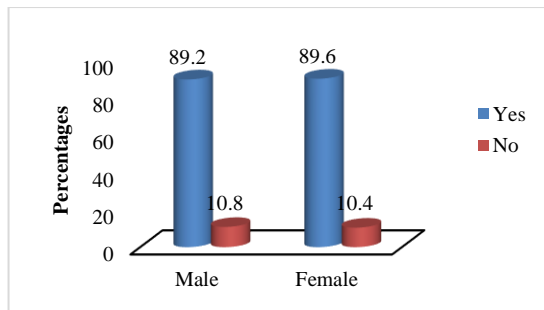
Figure 1. Distribution of Respondents by Awareness of Processing technology.
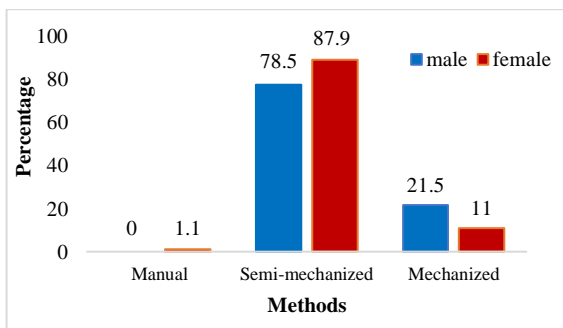
Source: Computed from Field Survey Data, 2019

Figure 2. Distribution of Respondents by Processing Techniques.

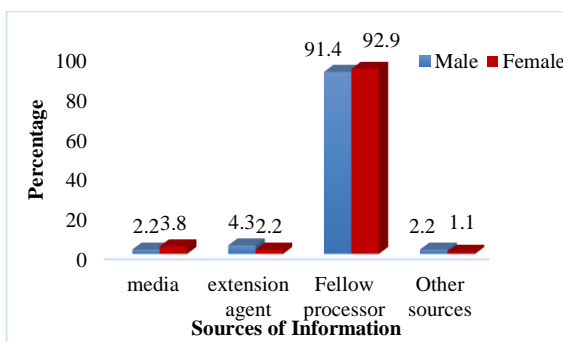Source: Computed from Field Survey Data, 2019

Figure 3. Distribution of Respondents by Source of Information.

Source: Computed from Field Survey Data, 2019

Factors influencing the use and intensity of use of processing Technology by Oil Palm Processors
Result of Maximum Likelihood Estimates of Adoption of Technology: First-Hurdle Probit Model

The results of the first hurdle estimate were shown in Table 1. It revealed how the independent variables affect the decision to adopt any of the oil palm processing technology.

The result of the first hurdle for factors affecting the adoption of technology among the female and male oil palm processors revealed that the coefficient of education was positively related and statistically significant at 1% and 5% levels respectively. This implies that the better educated oil palm processors are; the more likely they are in adopting improved processing technology.

The coefficient of access to credit by female respondents had a positive relationship and significant at 5%. This means that the better access to credit by the female processors, the more likely they adopt processing technology. Under the male counterpart, negative relationship and non-significance were obtained.

The coefficient of access to extension services was significant at 1% level and positively related with adoption of technology by female and male respondents. This implied that the better access to extension services the more likely they are in adopting processing technology. The result concords with the findings of Amanze *et al*. (2010) and Akpan *et al*. (2012) who stated that extension agent visit has the tendency of creating more awareness and better information to the farming household heads on the significance of processing technology.

The coefficient of membership of association was statistically significant and negative with adoption of technology under the female category, while it had positive relationship for male but not significantly influencing adoption. This shows that the greater the tendency of becoming a member of an association by the female processors, the less likely they will adopt processing technology. This could probably be the results of negative influence of participating members or lack of cooperation among female members.

The coefficient of the variable marital status positively influenced adoption by the female respondents but not significant while for the male respondents was inversely related and significant at 0.05 with the adoption of technology. It implies that being married will reduce the possibility of adopting processing technology among the male respondents. This may be attributed to the responsibilities associated with marriage such as caring for the family, thereby limiting availability of funds for purchasing the technology needed for processing operation.

The coefficient of year of experience among female processors was positively related and significant of 0.01, while that of male processors were positive and significant at 0.05 level. Therefore, it shows that the higher the years of processing experience, the more likely they adopt processing technology by female and male processors. This agrees with *a priori* expectation that experience brings about innovation. The direct association of years of processing experience and adoption of technology disagrees with the findings of Akpan *et al*. (2012) who reported that the probability of adopting technology by farming household heads decreased by 0.39% for every additional year they spent as farmers.

Table 1. Result of Maximum Likelihood Estimates of Adoption of Processing Technology-First-Hurdle Probit Model.

Explanatory Variable	Female		Male	
	Coefficient	P-value	Coefficient	P-value
Education	0.0620***	0.001	0.0085**	0.021
Land Ownership	-0.0576	1.270	-0.1311	1.000
Access to credit	11.9111**	0.039	-11.5533	0.092
Extension services	0.0194***	0.000	0.0847***	0.001
Distance to processing machine	0.0096	0.861	0.0367	1.020
Membership of Association	-0.0187***	0.008	0.0388	0.527
Marital Status	0.0936	1.000	-0.0020**	0.042
Experience	0.0019***	0.013	0.0043**	0.052
Constant	-6.0714**	0.020	-5.8983***	0.000
Number of observations	182		93	
Wald Chi^2 (18)	12.560	0.253	10.560	0.376
Log Likelihood	30.3863		11.5084	

Source: Computed from Field Survey, 2019. Significant at***1%, **5%

Result of Factors Affecting the Rate of Adoption of Processing Technology: Second-Hurdle Model

The results of the second hurdle model showed how independent variables influence the intensity or adoption rate of technology in the study area as depicted in Table 2. It was found that education, access to finance, extension services, and memberships of association were statistically remarkable. Explanatory variables among the female and male respondents, and the results satisfied the *a priori* expectation.

The coefficient of the educational status of female and male respondents were positive and significantly related (at 1% and 5%) respectively with the rate of adoption. It also implied that the better educated the processors are, the more the adoption rate. The result showed the years of formal training exposed the processors to different and better method of processing oil palm.

The results also showed that access to financial assistance was positive with significant values of 0.05 and 0.01 for female and male respondents, respectively. It connotes the better access to credit, the more the adoption rate of technology by the female and male respondent's respectively. This will heighten the potential to procure the needed equipment for processing of oil palm. Access to get financial assistance serves as a lubricant for efficient running of any business as it enables the processors to procure the necessary machinery for oil palm processing.

The coefficient of admittance to the services of the extension agents of the female respondents was positive and significantly related with the rate of technology adoption, while the coefficient of male counterpart was positive but not statistically significant. This implied that the better access to extension services the more the rate of adoption of technology by female and male processors. The result implies that extension services could expose the processors to recent processing methods through training resultantly augmenting the adoption rate of processing technology.

Again, the coefficient of male respondents' membership of association of male gender respondents proved positive and is remarkably related with the rate of technology adoption. This connotes the greater the tendency of becoming a member of an association by the male processors, the more the extent of adopting processing technology. The coefficient of membership of association was negative and not statistically significant for the female respondents.

The coefficient of year of experience was also negative and significant at a value of 0.05 for the female respondents, while it was positive but not statistically significant for their male counterpart. This implied that the higher the years of processing experience the less the rate of adopting the processing mechanizations among female processors but the more the extent of adoption among male processors. The inverse relationship of experience and adoption rate among the female processors might be due to the fact that processor trusting the old processing techniques they are comfortable with against the improved method.

Table 2. Result of Maximum Likelihood Estimates of Determinants of Rate of Adoption by Oil Palm Processors- Second Hurdle Model.

Explanatory Variable	Female		Male	
	Coefficient	P-value	Coefficient	P-value
Educational level	0.0030***	0.007	0.0082**	0.031
Access to credit	0.0728**	0.046	0.2408***	0.000
Method of land Ownership	-0.0952	0.632	-0.0322	0.910
Extension services	0.0326***	0.002	0.0329	0.450
Distance to processing machine	-0.0218	0.201	-0.0226	0.447
Membership of Association	-0.0048	1.254	0.002***	0.370
Marital Status	-0.0361	0.094	0.1028	0.008
Experience	-0.0002**	0.041	0.0027	0.623
Constant	0.352***	0.000	-0.150***	0.000

Conclusion

The study reveals that factors affecting the decision to adopt and intensity of adoption of processing technology for both genders respondents is extension services. Most of the processors source information from fellow processors instead of extension agents. This has adverse effect on the adoption and level of adoption of processing technology as majority of processors don't use the press but complete the palm oil processing using the traditional method to extract the oil (semi- mechanized method).

Recommendation

- Having discovered that access to extension services includes the factors influencing rate of adoption of processing technology therefore adequate accessibility to extension services should be provided by the government to increase the level of embracement of the processing technology in order to improve efficiency and productivity.
- Regarding access to credit, which is one of the factors influencing the extent of adoption of processing

technology among the female, processors should form cooperative among themselves to access government and non-governmental organization, micro- finance bank.

- the processors must be given proper orientation by extension agents on using the press, majority of the processors use only the digester, and then complete the processing of palm oil through traditional method (semi-mechanized method), most especially the female processors. Therefore, Farmer business school should be organized by extension officers in the area of study for the processors, especially the females in educating the processors on the use of the press (mechanized method).
- NGOs, Stakeholders and government should provide improved modern oil palm processing technology at subsidized rate to improve the processing of oil palm thereby increasing palm oil productivity and efficiency in South west, Nigeria.

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