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SOCIO-ECONOMIC FACTORS INFLUENCING THE ADOPTION OF IMPROVED OIL PALM FRUITS PROCESSING TECHNOLOGY IN KOGI STATE, NIGERIA.

Adah, O. C.[1], Akor, J.A.[2] and Ademu, A.[2]
[1]Department of Agricultural Economics and Extension,
Prince Abubakar Audu University, P.M.B. 1008, Anyigba,
Kogi State, Nigeria. Email: adahchris224@yahoo.com

[2]Department of Agricultural Education,
Kogi State College of Education, P.M.B. 1033, Ankpa, Kogi State, Nigeria.

ABSTRACT
The study investigated socio-economic factors influencing the adoption of improved oil palm fruits processing technology in Kogi State, Nigeria. Purposive, multistage sampling technique was used for selecting 240 oil palm fruits processors across the three agricultural zones with oil palm concentration. Primary data were collected for the study using a well-structured questionnaire. The data were analyzed using Logit regression analytical tool. The study found that sex (coefficient=0.4646) of the oil palm fruits processors was positively related to adoption of improved processing (machine) technology, but not significant. Also, the coefficient of age (-0.0110) was negative and insignificant. The relationship of household size with coefficient of -0.1296 was negative but significant at 5% level of error. The coefficients of education (0.0816), extension contact (0.0573), availability of credit (2.0645), awareness (1.3181) were positively related and significant to adoption of the improved processing technology. The coefficient of quality of fruit bunches was positively related but insignificant. Based on the findings, the study recommended that necessary influencing factors be enhanced and sustained for total and continuous adoption of improved processing technology through sustainable credit availability, increased extension contacts, and increased adoption awareness creation.

Keywords: Socio-economic, Adoption, Oil palm, Improved, Processing.

Introduction

The oil palm, *Elaeis guineensis Jacq* belongs to the family *palmae* and sub-family *coccideae* which contains 225 genera with over 280 species (Onucheyo, 2003). It is placed in the *Aracaceae* family along with coconut and date palm (http://fruit-crops.com/oil palm, 2011). It contains several hundred fruitlets. According to Malaysian Palm Oil Council (2008) the round fruitlets are orange red and ripen to dark purple; and on the average, two or three bunches are harvested from each tree. The trees produce fruit for thirty years, although it is more difficult to harvest as the trees grow. The fruit is composed of an outer skin called the exocarp; the fleshy mesocarp from which the palm fruit oil is squeezed, an inner nut called the endocarp; and a kernel inside the nut from which palm kernel oil is squeezed (Poku, 2002). According to Wahid *et al.* (2004) oil palm begins producing the oil-bearing fruit bunches as early as two and a half years after planting, while the lifespan of oil palm, as demonstrated by specimens planted in the Bogor Botanic Garden, Indonesia, is at least 120 years, and that the crop is generally grown for 20 – 30 years before being replanted, mainly because oil palm becomes too old to harvest economically.

The importance of oil palm to the economy of Nigeria cannot be overstressed. It is the source of palm oil which serves as the main cooking oil in most of the countries where it is produced (Food and Agriculture Organization (FAO), 2005; Owolarafe *et al*., 2007). In line with this, Gelder (2004) pointed out that palm oil is presumed to have formed part of diet in large parts of Africa (including Nigeria) well before written history began. Apart from its major role in our diets, it is also used industrially, especially in soap making, margarine, among others. The residue from palm kernel oil after extraction (palm kernel cake) is used in feeding a wide breed of livestock. The leaves of the crop are used in making brooms, mats, and roofing thatched houses/huts in rural areas. The bark of the frond is peeled and woven into baskets, flat materials for drying some agricultural produce/food items in the households as well as long cylindrical open ended basket for protecting planted seedlings from goats. The tree trunk are split and used for making building rafters. A sap tapped from the sterile inflorescence is processed into a drink called palm wine, which is a very rich source of yeast and enjoyed by numerous lovers both within and outside rural areas; the palm wine can be allowed to ferment and then distilled into a local gin (spirit) known as *Ogogoro* in Nigeria and *Akpetesin* in Ghana. According to Soyebo *et al*. (2005) the empty fruit bunch, the shell and fibre that remain after oil extraction are used for mulching, manuring and as fuel. The empty fruit bunch when burnt into ashes and processed is also used in making local black soap called *Oche'kele* in Igala and *Ose dudu* in Yoruba.

In recent decades, the domestic consumption of palm oil in West Africa has increased more rapidly than its production (Ojo *et al*., 2014). Further to this, West Africa known to be the leading producing region, has after centuries, now become a net importer of palm oil. How to address this situation remains the focus of research. Hence, the adoption of improved processing technology becomes vital and worthwhile. This is buttressed by Adah *et al*. (2015) that use of machines (improved processing technology) enhances production. Onoh and Peter-Onoh (2012) however, remarked that adoption is not a snap shot decision, but a mental process over a period of time. A farmer's/processor's decision about whether or not to adopt a recommended agricultural practice is recognized to occur over a period of time in stages under certain influences rather than being instantaneous.

Findings from studies by Ekong (1988), Agbamu (2006), Ani (2007) Ani *et al*. (2008), Agbarevo *et al*. (2010) and Fregene *et al*. (2008) which could vary depending on the socio-cultural characteristics of the individuals vis-à-vis the nature and type of technology involved, Ekong (1988), Agbamu (2006), Ani (2007) Ani *et al*. (2008), Agbarevo *et al*. (2010) and Fregene *et al*. (2008) indicated that the following factors determine adoption of technology:

Cost: New practice that are high in cost generally tend to be adopted more slowly.

Visibility: A new practice will generally be adopted quickly if it can be seen, hence the importance of demonstrations and visual aids. It is the wise man's saying that, "seeing is believing".

Complexity: New practices that are relatively simple to understand and use will generally be accepted more quickly than more complex ones.

Divisibility: Divisibility allows for partial adoption. Farmers can adopt those parts of an innovation that they like or that are consistent with other farming objectives. Obviously, therefore, the more divisible into component parts an innovation is, the more likely it is to be adopted. Under the traditional model of adoption, partial adoption will inevitably lead to complete adoption as it is viewed as a form of tried adoption.

Compatibility: A farmer's attitudes toward a new idea are often affected by his past experience with similar ideas. Thus, a farmer for instance, who

has already adopted hybrid seed maize is familiar with the concept of hybrid vigor and is more likely to adopt hybrid pigs and hybrid chickens. Farmer's values are likely to affect adoption in another way.

Utility: If a new practice is viewed by farmers as a major improvement over existing methods, it is likely to be adopted rapidly. It is reasonable to expect that the more economically beneficial an innovation is, the greater the rate of adoption.

Group Action: Some new ideas require group consensus and acceptance before they will be adopted. Others may be accepted on an entirely individual basis, provided they do not conflict with the community norms.

Educational Level of Farmers: Education makes people change-oriented. The educated men or women believe that change is a vehicle for improvement in human conditions, whereas the uneducated are averse to change. Change goes with some degree of risk-taking which the illiterate farmer would be unwilling to take.

Risk and Uncertainty: The term risk in this context refers to farmers' concerns about the likelihood that capital and other resources invested in adopting the technology/innovation may not produce any benefits. The risk is not in terms of capital outlay but can also involve the yield of the technology in one or a number of seasons.

Conflicting Information: Whenever any technology is introduced to any environment (community), it could be subject to debate with regard to its applicability, suitability and possible effectiveness. Farmers are prone to receiving information covering the technology from several sources. These sources could contradict one another. This circumstance makes it possible that in a situation where there are already some uncertainties, not adopting a new technology becomes an appropriate management strategy.

Economics: Under the classical model of adoption, the more an innovation, the more an innovation will provide concrete economic benefits, the greater the rate of adoption.

Empirically, Agwu (2006) reported that the major reasons for growing improved oil palms included: high yield and production of good quality oil, high market values of the produce and disease resistance attribute. The contrary would lead to non-adoption. Amusa *et al.* (2017) in a study of factors influencing processors' willingness to engage in mechanized palm fruits processing in Abia State, Nigeria reported that out of the nine explanatory variables, six (education, household size, experience, income, extension visits and membership of cooperative) were statistically significant at 1% and 5%. The coefficient of education of the processors was significant ($p < 0.05$) and positively influence their willingness to engage in mechanized palm fruits processing. This is in consonance with earlier finding that high literacy level has a positive effect on adoption of innovative oil palm practices (Agwu, 2006). Obinne (1991) earlier attested to the fact that education is a factor in the adoption of high yielding modern technologies. Onoh and Peter-Onoh (2012) in a study on adoption of improved oil palm production technology among farmers in Aboh Mbaize LGA of Imo State found that farmers' level of education positively and significantly influenced adoption of technology.

In a study of adoption of improved oil palm production practices on the livelihood assets of oil palm farmers in Kwaebibirem District of Ghana, Anaglo *et al.* (2014) observed that there was no significant difference ($p > 0.5$) between the age of the respondents and the level of adoption of improved oil palm production practices. This means that age as a personal characteristic of oil palm farmers does not influence the rejection or adoption of improved oil palm production practices. In a study on adoption trend of improved oil palm fruits processing technology in Kogi State, Nigeria, Adah *et al.* (2020) reported that there was low level of adoption of the palm oil extraction

technology which might not be unrelated to the high cost of the technology. This is in consonance with that of Anaglo *et al.* (2014) who reported that certain constraints faced by farmers, including processors do not allow them to fully adopt improved technologies and they include high costs of inputs and sometimes their unavailability.

Objective of the Study

The objective of the study was to determine factors influencing the adoption of improved oil palm fruits processing technology in Kogi State, Nigeria.

Research Question

The pertinent question for the study was:
What factors influence the adoption of improved oil palm fruits processing technology in the study area?

Research Method

The study was carried out in Kogi State, North Central Nigeria. It is most centrally located of all the states of the federation. It shares common boundaries with Nassarawa, Niger States and the Federal Capital Territory to the north; and Benue State to the east. To the west, it is bounded by Kwara, Ekiti and Ondo States and to the south by Enugu, Anambra and Edo States. The state has a total land area of 28,312.64 km^2 which lies between longitudes $5^0$18 E to $7^0$54 E and 6^0 30N to 8^0 42N. Its annual rainfall ranges between 1016mm in the driest parts of the state to 1524mm in the wettest parts (Kogi State Agricultural Development Project, 1993). The state is made up of twenty-one (21) local government Areas (LGAs). They are Adavi, Ankpa, Akaokuta, Bassa, Dekina, Yagba-East, Ijumu, Kabba/Bunu, Idah, Kogi, Ofu, Igalamela/Odolu, Yagba-West, Ibaji, Okene, Olamaboro, Okehi, Omala, Ogori-Magongo, Mopamuro and Lokoja LGAs. Kogi State is the 15th largest state in Nigeria (KOSEEDS, 2004) and the 20th most populous state in Nigeria based on preliminary 2006 census figure, of 3,278,487. The state comprises of three major ethnic groups namely, Igala, Ebira, and Okun (Yoruba); and other minor groups such as Bassa-Nge, Bassa-Komo, Nupe, Kupa, Hausa, Kakanda, Ogori-Magongo and Gwari. Majority of the people are farmers (Kogi State Agricultural Development Project, 1993). There are two district weather seasons in the state-dry and wet seasons. The wet season starts about the end of March and ends towards the end of October. The two most important rivers are Niger and Benue which form a confluence at Lokoja. Their numerous tributaries traverse across the length and breadth of the state. The farmland ranges from undulating hills with valleys in the western side to the plain lands in the eastern part of the state. Areas along the major rivers and their tributaries are riverine and sandy; which give room for *fadama* agriculture. Wide varieties of food and cash crops are grown in the state including oil palm. Livestock rearing and fish farming are also practiced in the state. Oil palm processing is one of the major agricultural activities in the study area particularly within the oil palm production areas of the state. They include areas such as Dekina, Ankpa, Ofu, Omala, Ogugu, Okpo, Kabba, Aiyetro-Gbede, Aloji, Ejule, Alloma, Egume, Anyigba, and Akpanya areas. Oil processing activities are done by both men and women as a source of livelihood. Both methods of processing are practiced in the area with very few availability of machine technology. There are oil palms in wild groves and plantations from where harvesting is done for processing by the owners or the fruit bunches and are sold to other commercial processors at affordable prices. Multistage sampling technique was used to select 240 oil palm fruits processors for the study. This was done based on the existing four (4) agricultural zones put in place by Kogi State Agricultural Development Project. They are Zones A (Aiyetoro-Gbede in Ijumu LGA); B (Anyigba in Dekina LGA); C (Koton-Karfe in Kogi LGA) and D (Alloma in Ofu LGA). The zones have 6 extension blocks (EBs) each with 8 cells per each, block. Based on the concentration of oil palm

processing activities, 3 zones: A, B and D were again purposively selected with 48 oil palm fruits processors from Zone A, B and 96 respondents each from Zones B and D. Data collected were analyzed using logit regression analysis tool. The model was specified as follows:

Lny = Ln (p/1 –P) -------

Ln (p/i - p) = f ($_{1\beta}$i Xi) + ei

Where:

Y = Adoption (1 = adopter, 0 = otherwise)

P = Probability of adopting the technology

Ln = Natural logarithm function

βi = Vector of logistic regression coefficients

X_i = Vector of independent variables given as follows:

X_1 = Sex (male = 1, female = 0

X_2 = Age of the farmer (in years)

X_3 = Household size (number of persons)

X_4 = Level of education (in years)

X_5 = Experience in palm oil processing (in years)

X_6 = Extension contact (No. of visits in the years)

X_7 = Availability of credit (Yes=1, 0 = otherwise)

X_8 = Awareness (Yes = 1, 0= otherwise)

X_9 = Quantity of bunches (number of bunches processed)

Results and Discussion

The respective effect of factors influencing adoption of improved oil palm fruits processing technology in the study area are presented in Table 1.

Table 1: Logit Regression Result for Effect of Socio-economic Factors on Adoption of Improved Oil Palm Fruits Processing Technology.

Variable	Coefficient	% of Odds	Standard Error	t-value
Constant	-1.7223	-459	1.103	-1.56
Sex	0.4646	59.14	0.354	1.31
Age	-0.0110	-1.11	0.018	-0.61
Household size	-0.1296	-13.80	0.051	-2.55*
Education	0.0816	8.51	0.032	2.56*
Experience	-0.0341	-3.47	0.022	-1.55
Extension contact	0.0573	5.91	0.021	2.71*
Availability of Credit	2.0645	688.14	0.395	5.23**
Awareness	1.3181	273.6	0.556	2.37*
Quantity of bunches	0.0001	0.01	0.0001	1.15
Chi square statistics =80.74; Log likelihood = -112.64**				

*, ** = Significant at 5% and 1% respectively.

Source: Computation of Data from Field Survey, 2012

Data from Table 1 shows that the sex of the oil palm fruits processors was found to be positively related to adoption of machine/improved technology but not significant. The coefficient of age (-0.0110) is negative and insignificant. The results also show that household size with coefficient (-0.1296) had a negative relationship with adoption of improved (machine) technology and is significant at 5% level of error. The coefficient of education (0.0816) was found to be

positive and significant at 5% level of error. The results also show that experience with coefficient (-0.0341) had an insignificant negative relationship with adoption of the technology. The coefficient of extension contact (0.0573) is positive and significant at 5% level of error. Data from Table 1 also show that the availability of credit with coefficient (2.0645) for the purchase of the technology had a significant positive relationship with the adoption of the improved (machine) technology. The coefficient of awareness (1.3181) is positive and had a t-value of 2.37. The results also show that there was a positive relationship between the quantity of bunches from which a processor have to extract palm oil and adoption of the technology.

The results imply that men were more likely to adopt the technology than women. This occurrence contradicts other findings. For example Oduruke (2003) in Anaglo *et al*. (2014) observed that females recorded higher adoption of cassava production technologies, while Ragasa *et al.* (2012) in Anaglo *et al.* (2014) indicated that females were less likely to adopt improved technologies.

The results also imply that advance in age reduces the likelihood of adopting the innovation, meaning that a unit increase in age, all other variables remaining constant, decreases the odds in favour of adopting the innovation. More technically, an increase in age by one year reduces the odds in favour of adopting the innovation by 1.1%. This agrees with the finding of the Ike (2008) who also reported a negative and insignificant result relationship between age and adoption of innovation.

The result on household size implies that a unit increase in household size decreases the odds in favour of adopting the innovation by 0.130 points. More technically, an increase in household size by one person reduces the odds in favour of adopting the innovation by 13.8%. This finding agrees with that of Sani *et al.* (2014) and Ofuoku *et al.* (2009) who observed a significant positive relationship between household size and adoption level. Households with larger size tend to attach greater importance to food security than those with small size. This is because as a man's household size increases he is faced with added responsibility of feeding the members. Food is usually the most basic need in every household and use of improved processing technology for higher output is usually opted for.

It was found that advance in education increases the likelihood of adopting the innovation. The result shows that increase in education increases the odds in favour of adopting the innovation by 0.082 points. More technically, an increase in education by an additional year of formal schooling increases the odds in favour of adopting the improved (machine) processing technology by 8.5%. This result agrees with the finding of Adejoh *et al.* (2010) in their study on the factors influencing the adoption of selected soil management technologies by yam farmers in Olamaboro LGA, Kogi State, that formal education has also helped farmers to obtain useful information from bulletins, agricultural newsletters and other print media sources of information. Sani *et al.* (2014) underscore the importance of the individual farmer to know how to seek for and apply information on improved farm practices. An illiterate farmer is generally apathetic and lacks choice and according to Flyvberg (1990) and Mabogunje (1999) lack of choice is due largely to lack of knowledge of which can be technical or prudential. Prudential knowledge is knowledge of what to do under different circumstances and involves the understanding of the social, economic, political and cultural context in which one lives.

The insignificant negative relationship of experience with adoption of the improved technology implies that increase in palm oil processing experience reduces the likelihood of adopting the innovation. Specifically, the result shows that an increase in experience by a point will decrease the odds in favour of adopting the

innovation by 0.0341 points or 3.47%. This result does not agree with the finding of Otunaiya and Akinleye (2008) who postulated that experience of farmers positively influences the adoption of improved maize technologies.

The extension contact positive and significant coefficient implies that increase in extension contact increases the likelihood of adopting the improved (machine) processing technology. The result shows that a unit increase in extension contact increases the odds in favour of adopting the innovation by 0.057 points. This means that four a unit increase in extension contact, the odds in favour of adopting improved processing technology increases by 5.9%. This result agrees with the findings of Otunaiya and Akinleye (2008) that contact with extension workers will increase the likelihood that a farmer will adopt improved technologies. Onemolease and Alakpa (2009) also found that the frequency of extension contacts promotes the adoption of improved technologies. This is not however in isolation of credibility, hence Ogunfiditimi (1981) stated that more credibility an agricultural extension worker possessed in the eye of his clientele while selling new ideas to them, the more will his clientele tend to accept his advice, suggestions and guidance.

Availability of credit to purchase the technology was found to have significant positive relationship with the adoption of the improved technology. This implies that the odds in favour of adopting the technology increases with the availability of credit to purchase the machine. The result shows that the odds in favour of adopting the technology increase by 2.065 (688.114%) with the odds of obtaining credit for its purchase. This further reinforces the fact that while palm oil processors are willing to adopt the technology, the constraints posed by lack of funds hinder this adoption.

Awareness is the first step in innovation since information is one of the major prerequisites for the widespread acceptance of agricultural innovations (Agbamu, 2006). The result implies that adoption of the improved (machine) technology increases with the level of awareness. Agwu (2006) found that the high adoption level for improved technologies is as a result of the farmers awareness that the technologies increase yields and minimize loses. More technically, the odds in favour of adopting the technology increases by 1.318 points (273.63%) for any point increase in the level of awareness.

The positive relationship between the quantity of bunches from which a processor have to extract palm oil and the adoption of the technology implies that the propensity to adopt the innovation increases by a negligible 0.0001 points (0.01%). This relationship was, however, insignificant.

Conclusion

The study has shown that certain socio-economic factors have been found to be positively significant to the adoption of improved oil palm fruits processing technology in the study area. Advance in education, increase in extension contacts, credit availability to purchase the technology and increase in level of awareness were found to have increased the odds in favour of adoption of the improved processing technology. Palm fruit bunches rated positive but insignificant. Household size was negatively related to the adoption of the technology but significant. Sex and age factors were not significant to the adoption of the technology.

Recommendations

Based on the findings from the study the following recommendations were made:

i. Efforts should be made by all the stakeholders in oil palm processing venture to ensure that the necessary influencing factors should be enhanced and maintained for total and continuous adoption of the improved oil palm fruits processing technology.

ii. Adequate credit availability for processors, extension visits increase for proper enlightenment and adoption awareness creation on the improved technology should be mounted and sustained.
iii. Extension staff should focus on both men and women when promoting adoption of improved oil palm production and processing practices.

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