Abstract
This paper is an essential investigation into socio-economic determinants of utilization of Nigerian Stored Products Research Institute (NSPRI) fish smoking kiln across ten (10) Local Government Areas (LGAs) of Osun State, Nigeria. Using a semi-structured questionnaire as research instrument, data for the study were purposively collected from one hundred and eighteen (118) fish processors who use the NSPRI smoking kiln in the state. Multiple regression analysis show that a correlation (R=0.362) exist between utilization of the screw press and the independent variables which include age, household size, level of education, years of processing experience, extension visits, and membership of social organization. R² value of 0.131 indicates that about 13% of the variation in utilization was explained by socio-economic variables included in the regression model. Two variables significantly influenced the decision of the respondents to utilize the NSPRI smoking kiln: household size and level of experience. Furthermore, adoption rate for the fish smoking kiln over a two-year period was 84.2%, and users of the kiln also moved from 118 to 747 within this period; an increase of 527%. The F-value of 2.782 confirms that there is significant relationship between the socio-economic characteristics of respondents and utilization of the NSPRI fish smoking kiln. Conclusively, the fact that independent variables included for this study were only able to explain 13% variation in utilization calls for mobilization of other variables not included in this study in further studies.

Keywords: Fish processors, Socio-economic factors, Smoking kiln, Utilization

Introduction/Background to the Study
Postharvest technologies are important parts of any agricultural system and are vital in all circumstances, whether there is surplus or deficit (Vilane, Shongwe, Motsa, & Shongwe, 2012). Utilizing improved postharvest technologies often results in reduced food losses, improved overall quality and food safety, and a higher profits for growers and processors of crops (Tashi, 2015). Understanding factors that lead to the adoption of agricultural technologies is necessary for targeting technologies appropriately, designing dissemination strategies and ultimately ensuring they have the intended impact (Wendland & Sills, 2008). It has also become necessary to regularly establish the rate of adoption/utilization of agricultural innovations by ultimate users; this would elicit information on usefulness and relevance of such innovation. Any effort at developing and promoting improved agricultural technologies should be able to assess progress/success or lack of it, and use such information to make future action more effective. Processing fish using improved processing technologies reduces cost, minimize waste and outright losses, extend shelf life of processed fish, and enhance its economic viability (Ravishankar, 2016). On the other hand, traditional or manual processing methods are labor intensive and cost ineffective (Akinbami, Aluko, & Momodu, 2012), for this reason a number of improved processing technologies have been developed and disseminated. Specifically, Nigerian Stored Products Research Institute (NSPRI), established in 1948, has fabricated and delivered some effective postharvest technologies in mitigating postharvest losses in Nigeria (Ubani & Okonkwo, 2011), chiefly amongst this is the improved NSPRI fish smoking kiln; consequently, the technology of interest for this study is the NSPRI improved fish smoking kiln.

A number of studies have identified numerous factors in utilization decision (Collinson, 2001; Adebayo, Omotayo, Garforth, & Awotunde, 2002; Pannell, Marshall, Barr, Curtis, Vanclay & Wilkinson, 2006). While socio-economic factors which is the focus of this study are not the only factors influencing utilization of postharvest technologies they are nonetheless one of the most important factors; they affect and shape decision patterns in agriculture (Caldas & Bankston, 2007; Tomul & Savasci, 2012). Undoubtedly, socio-economic factors have a substantial impact on the purchase and utilization decision of agricultural innovations generally (Dorward, Kydd, Morrison, & Urey, 2006). This study is predicated on the supposition that most often than not, improved postharvest technologies utilization are inherently determined by certain characteristics of end users.
Statement of the Problem
Notwithstanding the advantages that go with utilization of improved postharvest technologies and practices, many fish processors do not use the improved technologies optimally or completely use traditional methods which are characterized by arduous labor, excessive time consumption, and low productivity. The study was not only apt but timely because there are few studies if any to the best of our knowledge that have investigated factors influencing utilization of NSPRI improved fish smoking kiln, specifically in Osun State, Nigeria. That is, despite the contribution of the NSPRI fish smoking kiln to fish processing industry and food security in Osun State, Nigeria, empirical studies are not available or are at best rare particularly on socio-economic factors influencing the decision of fish processors to utilize the NSPRI fish smoking kiln. Most importantly, that most studies on utilization of agricultural technologies, especially postharvest technologies, were conducted several years ago indicate that the factors which influenced decision toward their utilization then may have changed considerably.

Objectives of Study
The study is guided by four specific objectives: to:-

1. Investigate socio-economic characteristics of fish processors in Osun state, Nigeria.
2. Investigate certain socio-economic characteristics that influence the decision to utilize the NSPRI fish smoking kiln by fish processors in Osun state, Nigeria.

Research Hypothesis
Ho Socio-economic characteristics of fish processors have no significant influence on utilization of NSPRI smoking kiln in Osun State, Nigeria.
H1: Socio-economic characteristics of fish processors have significant influence on utilization of NSPRI smoking kiln in Osun State, Nigeria.

Significance of the Study
The study is of significance because understanding factors which influence utilization of improved technology is essential in planning and executing technology related programs for meeting the challenges of food security in developing countries, Nigeria inclusive. Understanding the dynamics in improved post-harvest technology utilization decision can help researchers design technologies that will be widely adopted. Consequently, the variables that would be identified as key indicators towards explaining utilization of the NSPRI smoking kiln can be utilized within this context. Finally, it is anticipated that findings of this study would lead to policy recommendations that if adopted would lead to utilization of similar improved postharvest technologies in the country.

Furthermore, in order to avoid ambiguity and a weak evaluation of the phenomenon under study, this research limited itself to assessment of socio-economic factors influencing utilization of NSPRI fish smoking kiln. Also, the study was confined to ten (10) selected Local Government Areas (LGAs) out of the thirty-three (33) LGAs that presently exist in Osun state, namely Oshogbo, Irepodun, Orolu, Olorunda, Iwo, Ede South, Ede North, Egbedore, Irewole, and Aiyedire LGA. These LGAs are selected because NSPRI fish smoking kilns were distributed to these LGAs by NSPRI in time past. Furthermore, data for analysis for the study was restricted to primary data obtained from respondents for the study which took place in the month of June 2019.

Methodology
This study is a cross-sectional survey; cross-sectional surveys collect and analyze data from a population, or a representative subset, at a specific point in time to make inferences about a population of interest at one point in time. From a list of recipients of the kiln provided by All Farmers Association of Nigeria (AFAN) Osun State chapter, phone calls were put through to respondents to fix appointment to see firsthand the kilns. LGAs and respondents for the study were purposively selected; referral method better known as snowballing was handy for accomplishing this goal.

Primary data was collected by the researchers through individual interviews, using a 14-question semi-structured questionnaire that was subjected to a pre-survey. There were thirteen closed-ended questions and one open-ended question on the questionnaire. To ensure that our instrument possesses both face and content validity in accordance with objectives of the study, our research instrument was validated by an expert in research methodology from the Department of Sociology, University of Ilorin, and a senior associate from the Department of Research Outreach Services, Nigerian Stored Products Research Institute, Ilorin, Kwara State. Test for reliability for the research instrument was conducted in Ilorin, KwaraState using a test-retest method with 15 randomly selected fish processors within an interval of two weeks. The score for each exercise was computed and subjected to Pearson product moment correlation analysis.

A combination of analytical techniques was used for data analysis to achieve the objectives of the study; descriptive and inferential statistics was used in the analysis of generated field data. This is because the data collected were both qualitative and quantitative in nature. Descriptive statistics namely frequency count, percentages and mean were used to achieve objectives (1), (3) and (4). While linear Regression model was used to achieve objective (2) and test hypothesis for the study which states that socio-economic characteristics of fish processors have no
significant influence on utilization of the NSPRI fish smoking kiln in Osun state. A handful of formulae exist to calculate adoption rate but experts in the field look at the peculiarity of phenomenon under investigation to determine the suitability of formula to use; to achieve objective (3) the formula beneath was used:

\[
\frac{\text{Number of new users}}{\text{Total number of users}} \times 100
\]

To achieve objective (4) we used this formula:

\[
\frac{\text{Total number of current users} - \text{Number of initial users}}{\text{Number of initial users}} \times 100
\]

With this formula, you can calculate adoption rate for the month of July for instance; search out the total numbers of users who used the innovation for the first time any day between July 1st and July 31st and divide that number by total number of users by July 31st the last day of the month, then multiply by 100.

Data Presentation, Analysis and Discussion

Background Information of Respondents

Table 1 also shows that 6% (7) of the respondents fall in the less than 30 years age category, 27.1% (32) were within the age range of 30 to 39, 46% (54) were between 40 and 49 years, 15.3% (18) fell within the 50 and 59 age range, while 5.9% (7) were either 60 years of age or more. The average age of the respondents was 43.8 years, indicating a relatively high proportion of processors have passed middle age.

Overall, the result implies that the respondents are relatively young, but have passed United Nations Educational, Scientific and Cultural Organization (UNESCO) standards for youth; according to UNESCO (2014) youth falls within the 15-24 years age bracket. Most significantly, the result implies that there is low participation of the youth in agro-processing in the study area; corroborating the position of Abdul-Lateef & Rashid (2015).

Table 1 confirms that 5% (6) of the respondents are single, followed by 92% (196) who are married. Again, about 1% (1) of our respondents are either divorced or separated, and about 1.7% (2) are widowed. The result implies that majority of the fish processors using the screw press in the study area are married. Married processors are likely more to use the NSPRI fish smoking kiln because they are responsible for family welfare and need to earn substantially from fish processing to support their families, hence they seek to try out and use technologies that could increase their output and earnings. Our finding is similar, and in agreement with the position of Agbamu (2006) that married farmers adopt and utilize improved agricultural technologies more than single farmers.

Table 1 shows that the households that have between 1 to 3 members made up 11.9% (14) of the respondents, 4 to 6 member household constituted 43% (51), 7 to 9 member constituted 31.4% (37), while those households with 10 members or more made up 13.6% (16) of the respondents. The average household size of the respondents is 6.3 members; a number that is a little higher than the national average of 6.1. The inference of this result is that the respondents have large-size households.
Table 1 also showed that 8.8% (10) of the respondents lacked formal education, 9.3% (11) had primary education, while 50.0% (59) had secondary education. However, 32.2% (38) of the respondents had education beyond secondary education. An examination of the level of formal education is needed because; it determines to what extent the processor could imbibe new ideas as well as innovations. The result indicated that majority of respondents had formal educational and at secondary school level. In line with Ayoade (2013) education aids farmers to easily understand the potentials in utilization of improved agricultural technologies.

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Table 1 also showed that 71.2% (84) of the respondents had below 6 years of processing experience, 18% (17) had between 6 and 10 years of experience, while 6% (7) had between 11 and 15 years of processing experience. Furthermore, 6% (7) of the respondents had between 16-20 years’ experience, while 0.8% (1) had between 21 and 25 years processing experience. Processors with 26 to 30 years processing experience constituted 2% (2) of the respondents. Majority of the processors had processing experience of less than 6 years. The mean years of processing experience is 7.9 years, meaning that the fish processors are experienced; processing experience is most likely to have a range of influence on utilization because with increase in working years, the processor gets more adept at processing. Furthermore, processing experience also gives an idea of processors management capability.

Table 1 further shows that 86% (102) of the respondents have not had contact with extension agents in the past year, while 14% (16) have had just one (1) contact(s). The result signifies that extension contact in the study area is low. The implication of this is that respondents would have low awareness level of agricultural technologies in general, and other relevant fish processing technologies for fish processing. The result validates the verdict of Oluwasuji & Akanni (2014) that farmers contact with extension services in Nigeria is poor.

The result in Table 1 finally shows the distribution of the respondents by their membership of social groups. The result shows that 46.6% (55) of the respondents do not belong to any social group, while 37.3% (44) belonged to one (1) social group. Furthermore, 16.1% (19) of the fish processors belonged to two (2) social groups. This result implies that majority of the respondents do not belong to any social group. As such, there is tendency that respondents would not benefit much from government intervention policies and programs which are majorly targeted at association; governments in recent times have focused majorly on associations or groups for assistant and involvement in developmental programs.

Table 1: Socio-economic information of respondents

<table>
<thead>
<tr>
<th>Socio-economic Characteristics</th>
<th>Frequency</th>
<th>Percentage%</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>47</td>
<td>39.8</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>71</td>
<td>60.2</td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 30 years</td>
<td>7</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>30-39 years</td>
<td>32</td>
<td>27.1</td>
<td></td>
</tr>
<tr>
<td>40-49 years</td>
<td>54</td>
<td>45.8</td>
<td>43.8</td>
</tr>
<tr>
<td>50-59 years</td>
<td>18</td>
<td>15.3</td>
<td></td>
</tr>
<tr>
<td>60 years and above</td>
<td>7</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>6</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>109</td>
<td>92.4</td>
<td></td>
</tr>
<tr>
<td>Divorced/separated</td>
<td>1</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>Widowed</td>
<td>2</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td><strong>House Hold Size</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3</td>
<td>14</td>
<td>11.9</td>
<td></td>
</tr>
<tr>
<td>4-6</td>
<td>51</td>
<td>43.2</td>
<td></td>
</tr>
<tr>
<td>7-9</td>
<td>37</td>
<td>31.4</td>
<td>6.3</td>
</tr>
<tr>
<td>10 and above</td>
<td>16</td>
<td>13.6</td>
<td></td>
</tr>
<tr>
<td><strong>Level of Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education (0 years)</td>
<td>10</td>
<td>8.5</td>
<td></td>
</tr>
<tr>
<td>Primary education (6 years)</td>
<td>11</td>
<td>9.3</td>
<td></td>
</tr>
<tr>
<td>Secondary education (12 years)</td>
<td>59</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td>Tertiary education (14 years)</td>
<td>38</td>
<td>32.2</td>
<td></td>
</tr>
</tbody>
</table>
Socio-economic Factors Influencing the NSPRI Smoking Kiln

The multiple regression model shows the influence made by the independent variables (age, household size, level of education, processing experience, extension contact, and membership of social group) on the dependent variable (utilization of NSPRI fish smoking kiln). The model was used to determine the specific contribution of each independent variable and the total variance explained by all the variables on factors influencing the utilization of the smoking kiln (Table 2).

The multiple regression model takes the form of an equation that contains a coefficient “B” for each predictor. The first part of Table 2 gives an estimate for these “B” values and these values indicate individual contribution of each predictor to the model. The “B” value tells us about the relationship between utilization of the NSPRI fish smoking kiln and each predictor. If the value is positive we can tell that there is a positive relationship between the predictor and the outcomes; whereas a negative coefficient represents a negative relationship. The “B” value also tells us to what degree each predictor affects the outcome if the effect of all other predictors is held constant. If the value in the column labelled “sig” is significant, depending on the set significant level, then that predictor is making a significant contribution to the model; however, the smaller the value of “sig” and the larger the value of “t” the greater the contribution of that predictor.

Also, in Table 2, each of the Beta values has an associated standard error indicating to what extent these values would vary across different samples. The standardized version of the “B” value is not dependent on the units of measurement of the variables. The standardize beta values show the number of standard deviation that the outcome will change as a result of one standard deviation change in the predictor. The standardize Beta values are all measured in the standard deviation units so are directly comparable: therefore, they provide a better insight into the importance of a predictor in the model.

The result of the multiple regression analysis as shown on Table 2 indicates that a correlation (R= 0.36) exist between utilization of the NSPRI fish smoking kiln and the independent variables. The R is the simple correlation between the socioeconomic variables and utilization of the smoking kiln. Table 2 also shows that R² (coefficient of multiple determination: R² measures the proportion of variation in Y explained by X) value is 0.131; signifying that about 13% of the variation in utilization of the NSPRI smoking kiln was explained by variables included in the model. The remaining 87% could be attributed to the variables not included in the regression model. The adjusted R² gives some idea of how well the model generalizes, and ideally the value should be close to the value of R². The difference in R² and adjusted R² for the model is a fair bit (0.131 – 0.047 = 0.084 or 4.7%); this means that if the model were derived from the population rather than from the sample it will account for approximately 4.7% less variance in the outcome. Furthermore, because, the predictors identified in the study were only able to explain 13% of variation in the utilization of NSPRI fish smoking kiln indicates that there is need to mobilize new factors.

From the result of the regression analysis as shown in Table 2, age, level of education, extension contact, and membership of social groups lack statistical significance and by implication they do not significantly influence NSPRI fish smoking kiln utilization. What this means is that whether processors are old or young, educated or not educated, visited by extension agents or not, belong to social groups or not does not determine their utilization of the smoking kiln. However, variables that influence utilization of the smoking kiln by respondents are household size (-0.370) which was statistically significant at 5% (Beta= -0.245), level of experience (0.285) which was also statistically significant at 5% (Beta=0.234). Our result regarding household size isnot in harmony with Tijjani (2010) who in his research found household size to be an insignificant factor in the adoption of recommended cowpea production practices. However, our finding corroborates Bonabana-Wabbi (2002) who maintains that
Socio-economic Factors Influencing the NSPRI Smoking Kiln

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Table 2: Multiple regression showing relationship between utilization and socio-economic variables and their contribution in explaining the variability in utilization of NSPRI fish smoking kiln (N=118)

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>3.665</td>
<td>.744</td>
<td>4.928</td>
<td>.000</td>
</tr>
<tr>
<td>Age(X₁)</td>
<td>-.231 NS</td>
<td>.158</td>
<td>.165</td>
<td>1.459</td>
</tr>
<tr>
<td>Household size(X₂)</td>
<td>-.370</td>
<td>.180</td>
<td>-.245</td>
<td>2.050</td>
</tr>
<tr>
<td>Level of education(X₃)</td>
<td>.142 NS</td>
<td>.142</td>
<td>.094</td>
<td>-.997</td>
</tr>
<tr>
<td>Level of experience(X₄)</td>
<td>.285</td>
<td>.118</td>
<td>.234</td>
<td>2.408</td>
</tr>
<tr>
<td>Extension contact(X₅)</td>
<td>.375</td>
<td>-.047</td>
<td>.483</td>
<td>.630</td>
</tr>
<tr>
<td>Association(X₆)</td>
<td>.018 NS</td>
<td>.188</td>
<td>.010</td>
<td>-.094</td>
</tr>
</tbody>
</table>

R² = 0.362
R² = 0.131
Adjusted R² = 0.084
F-value = 2.782

The estimated regression equation therefore is: Y = 3.665 + 0.165(-.231) + -.245(-.370) + 0.094(0.142) + 0.234(0.285) + -0.047(0.181) + 0.188(0.018)+0.744

Test of Hypothesis

H₀: Socio-economic characteristics of fish processors have no significant influence on utilization of NSPRI smoking kiln in Osun State, Nigeria.
H₁: Socio-economic characteristics of fish processors have significant influence on utilization of NSPRI smoking kiln in Osun State, Nigeria.

Decision Rule: Reject Null hypothesis if calculated-F is greater than tabulated-F.

The F-test sums the predictive power of all independent variables. A high F-ratio would indicate that the alternative hypothesis is compatible with the observed data. As shown on Table 2, the F-value (F-calculated) is 2.782 which is greater than F-critical value (F-tabulated) of 1.96 at 0.05 significant levels. Therefore, we reject the null hypothesis and accept the alternative hypothesis which says “Socio-economic characteristics of fish processors have significant influence on utilization of NSPRI smoking kiln in Osun State.”

Conclusion and Recommendation

Factors that significantly influence the utilization of the NSPRI fish smoking kiln among respondents are limited to household size and years of experience of respondents. In other words, household size and years of experience are important predictors and factors to consider in the utilization of similar technologies in the study area. Furthermore, that the NSPRI smoking kiln had an 84.2% adoption rate, and 527% increase in number of users over a two year period is a pointer that the technology has considerable relative advantage over traditional fish smoking kilns in the study area. Conclusively, for the fact that independent variables included for this study were only able to explain a meager 13% variation in utilization of NSPRI fish smoking kiln, this study recommend for mobilization of other variables not included in this study in further studies; this for most part should cut across technological and institutional factors.

References


