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# Factors Affecting Women Labor Utilization in Staple Crops Value Chains Activities in Southeast Nigeria

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***Abstract*** **- This paper identified socioeconomic, institutional and technological factors affecting women labor utilization in an on-farm and less rewarding staple crop value chain activities such as clearing, cultivation, planting and weeding compared to more rewarding off-farm post-harvest activities that facilitate input and output market such as threshing, shelling, processing, storage and marketing using data collected from 400 randomly selected women farmers in southeast Nigeria during 2019/20 crop year. Multinomial-logit results show that complementary input such as the use of credit, hired labor, fertilizers, agrochemicals, more land, adult men/women and extension services had a negative relationship with women's engagement in less rewarding farm operations. The constraint militating against women's labor utilization in staple crop value chain activities were lack of storage facilities, lack of credit, lack of improved input, poor road network and land tenure problems. The paper recommends institutional framework through extension education, technology-supply industries, financial institutions, improved road network to enhance women's labor engagement in more beneficial value chains activities such as post-harvest operations since women farmer selling to the market are more rewarding than engagement in clearing, cultivation, planting and weeding so that more women will participate in the market.**
***Keywords:*** **Staple-Crops, Women's Labor, Multinomial-Logit, Nigeria, Value-Chains**

## I. INTRODUCTION

There is currently a renewed worldwide interest in innovative-based food systems that will facilitate input use especially chemical fertilizers, improved seeds, agro-chemicals, machinery, irrigation as well as participate in the market in countries where agriculture is the main occupation of the poor (Dillon & Barrett, 2016; Sheahan & Barrett, 2017). But the agricultural sector in many developing countries is underperforming, in part because women's labor was mostly engaged in on farm, low input and less rewarding farm operations such as clearing, cultivation, planting and weeding in staple crops value chains compared to nonfarm post-harvesting operations and these resulted to US$ 8.9 billion worth of crops that rot away annually in Nigeria between the farm and fork (AgroNigeria, 2017). Research investments and its deliveries have been concentrated primarily on increasing on-farm staple crops value chains and until recently, off-farm post-harvest technologies in staple crops value chains was negligible (Abass *et al*., 2014; Opata & Ogbonna, 2015). The nonfarm post-harvesting operations including processing to more stable form and participating in the market and other staple crop value chain activities could reduce food losses and increase the amount of food available for consumption as well as women farmer selling to the market for more rewarding value chain activities than engagement in clearing, cultivation, planting and weeding for household consumption mainly.

Post-harvesting in Nigeria takes place in a mostly scattered unorganized enterprise where critical infrastructure and regulatory services are acutely short in threshing, shelling, winnowing, storage, processing, transportation and marketing of grains, root, tubers, fruits, and vegetables. Off-farm postharvest operations constitute a critical missing link in the staple food value chains development in Nigeria. There are socio-economic, technological and institutional limitations to engagement of women labor in none farm post harvesting and commercialization of agricultural farms in Nigeria (Buchner *et al.*, 2012; Ochieng, Veettil, & Qaim, 2017; Opata, 2018; Sibande, Bailey, & Davidova, 2017). It is widely accepted that non engagement of women labor in postharvest value chain activities and engagement in less rewarding on farm operations reduce welfare and livelihood strategies as well as low access to input and output market including agrochemical, fertilizers, credit, and improved seed perpetuating poverty (Doss, 2016; Doss *et al.*, 2011; Ebata, Alejandra, Pacheco, & Cramon-taubadel, 2017; Masamha, Uzokwe, Ntagwabira, Gabagambi, & Mamiro, 2017; Montalbano, Pietrelli, & Salvatici, 2018; Sibande *et al.*, 2017). Because women play a prominent role in value chain of staple crops activities in Africa, institutional and technical environment that will enable the use of inputs by women to enable them to engage in off-farm and more rewarding farm operations for economic empowerment is vital to agricultural transformation. This is only possible if markets access is addressed by understanding factors such as socio-economic, institutional and technical factors that increase women's labor engagement in more rewarding off-farm value chain activities that are linked to input and output market. However, the benefits of participating in agricultural value chains that are more rewarding for women are determined by their control of productive

resources and household-level decisions. Women farmers tended to have a lower output per unit of land and were less likely to be active in commercial farming than men because of gender-specific constraints. The constraints included a high rate of illiteracy among women, work and family responsibilities for women, limited access to training as well as market information and lack of access to extension services.

Despite the existence of gender policies in Nigeria, gender differences in access to complementary inputs, incentives, and information have persisted (Federal Ministry of Women Affairs and Social Development, 2007). There is a low level of consciousness about roles women play in the development of Nigeria; deep-rooted cultural beliefs and traditional practices that prevent women from playing their full roles in the development process of the country; lack of appropriate technology to reduce the workload of women; shortage of properly qualified female development agents to understand, motivate and empower rural women by eliminating the major constraints hindering their progress (Ajaero, 2017; Doss, Meinzen-Dick, Quisumbing, & Theis, 2018; Kassie, Stage, Teklewold, & Erenstein, 2015; Masamha *et al.,* 2017; Quisumbing, 1996). There is little information available on factors affecting women's labor utilization in staple crop value chains in southeast Nigeria. Most studies on value chains of staple crops have not addressed the issues of women labor utilization in staple crop value chains such as clearing, cultivation, planting weeding compared to off-farm staple crop value chains activities in dealing with transaction costs and returns that could enable commercialization (Jagwe, 2010; Masamha *et al.,* 2017; Omiti & Mccullough, 2009). There is little information available regarding the influence of socio-economic, institutional, and technological factors on the choice of women labor utilization in the value chains of staple food crops at the household level in southeast Nigeria. In fact, none of the work on women studies in labor utilization has analyzed the socio-economic, institutional and technological factors influencing the choice of women labor utilization in various value chain activities starting from land preparation, planting, weeding, compared to post-harvest activities, which is the focus of this study. This will inform policies to tackle systematic local-specific constraints faced by women farmers utilizing labor at the different level of value chains of staple crops.

## II. LITERATURE REVIEW

Women generally play key roles in advancing agriculture because of their close affinity to natural resources and socio-cultural roles as food growers (Opata & Arua, 2017). The estimated shares of labor force participation of women in Africa have been well studied in the literature. Some studies argued that women's engagement in staple crop value chains accounts for 60 to 80 percent of the agricultural labor used to produce food both for household consumption and for sale (Faso & Division, 1995; Momsen, 1991). However, the statistical basis for the proportion of women share of staple crop value chain labor has been questioned before (Doss *et al.,* 2011; Jackson, 2005). Doss *et al.,* (2011) own view on women's involvement in staple crop value chain in Africa is that they are involved only in the post-harvest value chains activities of staple crop limiting their contribution to national economy. Recently, two studies analyze the contribution of women labor to crop production with various results which differs with the region. Taking the female share of the agricultural labor force as a proxy (calculated as the total number of women economically active in agriculture divided by total population economically active in agriculture), (Doss *et al.,* 2011) suggests that women's labor contribution to staple crop value chains is slightly less than half. Palacios-Lopez *et al.,* (2017) used the Living Standard Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) initiative to compare male and female labor participation. They found that female labor share amount to slightly more than 50 percent in Uganda, Tanzania and Malawi (56, 52 and 52 percent respectively), which is also consistent with the slightly higher share of women in these population (52, 53 and 51 percent respectively).

Female-headed households represent between 3 and 38 percent of all households and produce between 2 and 17 percent of the value of food produced (Doss *et al.,* 2011). However, not only that none of these studies investigated the influence socio-economic, technological and institutional factors on the choice of women labor in crop production, the methodology adopted by most of these studies was purely descriptive. This study contributes to the ongoing empirical debate by analyzing the key technological, socio-economic and institutional determinant of choice of women labor utilized for value chains of staple crop in southeast Nigeria with a view to developing inclusive, evidence-based food security policies and strategies.

We undertake the task outlined on the specific objectives by employing the multinomial logistic regression model approach. The article is organized as follows. The next section outlines our methodological approaches including the framework/model we applied to address our specific objectives. Section 3 presents the results while the discussions follow in section 4. The final section concludes and draws policy implications.

## III. MATERIALS AND METHODS

### *A. Study Area and Data*

The study area is the South-east geopolitical zone of Nigeria. Five states constitute this zone: Abia, Anambra, Ebonyi, Enugu, and Imo, covering latitude $4^0$ 50'N to $7^0$ 10' N and longitudes $6^0$ 40'E to $8^0$ 30'E. The zone spreads over a total area of 78,618 $km^2$, representing 8.5 percent of the nation's total land area. The area has a total population of 16,381,729, (World Meters, 2019).

Six-stage sampling technique was employed for the study. In stage one, two states were randomly selected from the five states using a simple random sampling technique. The two states were Enugu and Abia. In stage two, all the three zones in Abia were selected while three zones from six zones were selected using simple random sampling techniques. Zones from Abia were Aba, Umuahia, and Ohafia while those from Enugu were Enugu, Awgu and Nsukka zones. Stage three involves selection of local government areas, twelve rural local government areas were selected from the thirty-four Local Government Areas. Stage four involved the selection of rural communities. This stage involved a random selection of two rural communities from each of the twelve (12) rural Local Government Areas selected. This amounted to twenty-four (24) rural communities that were used for the study. Stage five involves selection of villages, a list of villages that make up each of the twenty-four (24) communities were gotten from the community head. From this list, two (2) villages were randomly selected from each of the sampled twenty-four (24) communities. This amounted to forty-eight (48) villages. Stage six is the selection of respondents. Here, the list of respondents was gotten from the village heads where there are women farmers, and from there eight or nine (8 or 9) household farmers were randomly selected from each village. This amounted to four hundred (400) household farmers. In each selected household, relevant female and male farmers were interviewed.

Data collection was undertaken during 2016 and 2017, and primarily involved administration of a set of structured questionnaires to each category of respondents, including using open-ended questionnaires for focus group discussions. Apart from primary sources, secondary information was sourced from journals, periodicals, United Nations, World Bank etc. We combined descriptive and inferential statistics in the analytical framework presented in the next section to analyze our data (using STATA).

*B. Analytical Framework and Empirical Model*

The choice of women's labor utilization in staple crop value chain activities can be understood by examining choices of women labor engagement in staple crops value chain activities in a constraint utility optimization framework where an individual woman is assumed to maximize her income from engagement in labor in terms of selection of different on farm and off-farm activities subject to a set of socio-economic, technological and institutional constraints. The framework is couched around five value chains activities [clearing (on farm operation 1), cultivation (on farm operation 2), planting (on farm operation 3), weeding (on farm operation 4) and post-harvesting (off-farm operation 5)] in a rural environment where women labor is utilized in varying quantities for clearing, cultivation, planting, weeding and post-harvesting. Choice of women labor utilization in this context is categorized based on their selection for either clearing or cultivation or planting or weeding and comparing them to post-harvesting and the outcome depend on the socio-economic, institutional and technological factors influencing their choices. A frame of Multinomial logit regression model was used to present labor utilization decision choices. Here the dependent variables (labor utilization) are defined to have five possible conditional (choices) probabilities across clearing, cultivation, planting, weeding, and post-harvesting (i.e. the five on the farm and off-farm operation choices used in this study). The conceptual foundation for choice models is often appropriate for modeling discrete choice decisions such as the case of this study. In the implementation model, women labor utilization in on-farm and off-farm operations choices are modeled with a five-equation system. Thus a set of coefficients $\beta^{(1)}$, $\beta^{(2)}$, $\beta^{(3)}$, $\beta^{(4)}$, $\beta^{(5)}$ corresponding to five possible options step 1, 2, 3, 4, 5 in on-farm and off-farm operations can be estimated as:

$$\Pr(Z=1)=\frac{e^{x\beta(1)}}{e^{x\beta(1)}+e^{x\beta(2)}+e^{x\beta(3)}+e^{x\beta(4)}+e^{x\beta(5)}} \quad \text{……..(1)}$$

$$\Pr(Z=2)=\frac{e^{x\beta(2)}}{e^{x\beta(1)}+e^{x\beta(2)}+e^{x\beta(3)}+e^{x\beta(4)}+e^{x\beta(5)}} \quad \text{…….……(2)}$$

$$\Pr(Z=3)=\frac{e^{x\beta(3)}}{e^{x\beta(1)}+e^{x\beta(2)}+e^{x\beta(3)}+e^{x\beta(4)}+e^{x\beta(5)}} \quad \text{……..(3)}$$

$$\Pr(Z=4)=\frac{e^{x\beta(4)}}{e^{x\beta(1)}+e^{x\beta(2)}+e^{x\beta(3)}+e^{x\beta(4)}+e^{x\beta(5)}} \quad \text{……..….(4)}$$

$$\Pr(Z=5)=\frac{e^{x\beta(5)}}{e^{x\beta(1)}+e^{x\beta(2)}+e^{x\beta(3)}+e^{x\beta(4)}+e^{x\beta(5)}} \quad \text{.....(5)}$$

The model, however, is unidentified because there is more than one solution t $\beta^{(1)}\ \beta^{(2)}\ \beta^{(3)}\ \beta^{(4)}\ \beta^{(5)}$ that leads to the same probabilities for Z = 1, Z = 2, and Z = 3, Z = 4, Z = 5.

To identify the model, one $\beta^{(1)}$, $\beta^{(2)}$, $\beta^{(3)}$, $\beta^{(4)}$, $\beta^{(5)}$ is arbitrarily set to 0. That is, if we arbitrarily set $\beta^{(5)}$ = 0 the remaining coefficients $\beta^{(1)}$, $\beta^{(2)}$, $\beta^{(3)}$, $\beta^{(4)}$ would measure the change relative to the Z = 4 groups. In order words, we would be comparing the most vertically differentiated or rewarding off-farm operations (5) that engages women in input and output market with the less beneficial on-farm operations (1 2 3 & 4). Setting $B^5$ = 0, the above equations become:

$$\Pr(Z=1)=\frac{e^{x\beta(1)}}{e^{x\beta(1)}+e^{x\beta(2)}+e^{x\beta(3)}+e^{x\beta(4)}+1} \quad \text{…….(6)}$$

$$\Pr(Z=2)=\frac{e^{x\beta(2)}}{e^{x\beta(1)}+e^{x\beta(2)}+e^{x\beta(3)}+e^{x\beta(4)}+1} \quad \text{……(7)}$$

$$\Pr(Z=3)=\frac{e^{x\beta(3)}}{e^{x\beta(1)}+e^{x\beta(2)}+e^{x\beta(3)}+e^{x\beta(4)}+1} \quad \text{….……..(8)}$$

$$\Pr(Z=4)=\frac{e^{x\beta(4)}}{e^{x\beta(1)}+e^{x\beta(2)}+e^{x\beta(3)}+e^{x\beta(4)}+1} \quad \ldots\ldots\ldots\ldots(9)$$

$$\Pr(Z=5)=\frac{e^{x\beta(5)}}{e^{x\beta(1)}+e^{x\beta(2)}+e^{x\beta(3)}+e^{x\beta(4)}+1} \quad \ldots\ldots\ldots\ldots(10)$$

The relative probability of Z = 1 to a base category is $\frac{\Pr(Z=1)}{\Pr(Z=5)}=e^{x\beta(1)}$. If we call this the relative likelihood and assume that X and $\beta_k^{(1)}$ are vectors equal to ($x_1$, $x_2$,…; $x_k$) and ($\beta_1^{(1)}\beta_2^{(1)}\ldots,\beta_k^{(1)}$) respectively. The ratio of the relative likelihood for one unit change in $x_i$ relative to the base category is then

$$\frac{e^{B_1^{(1)}X_1}+\ldots+\beta_1^{(1)}(x_1+1)+\ldots+\beta_k^{(1)}xk}{e^{\beta_1^{(1)}X_1+\ldots+\beta_K^{(1)}XK}}=e^{\beta_1^{(1)}} \quad \ldots\ldots\ldots..(11)$$

Thus, the exponential value of a coefficient is the relative likelihood ratio for one unit change in the corresponding variable as reported by (Opata, 2018). Considering that women farmer make decisions regarding which staple crops value chain activities to perform with their labor (for example, land clearing in on-farm operation 1; cultivation in on-farm operation 2; planting in on-farm operation 3; weeding in on-farm operation 4 and post-harvesting off-farm operation 5). Thus if $Z_1$, $Z_2$, $Z_3$, $Z_4$, $Z_5$ are the dependent variables representing (on-farm operation 1), which denotes land clearing; (on-farm operation 2), denoting cultivation; (on-farm operation 3), which denotes planting; (on-farm operation 4) denoting weeding and (off-farm operation 5) denoting post-harvesting including processing, storage, marketing in this paper. Then Multinomial logit model will be fitted to test how dependent variables: staple crop value chains activities 1, 2, 3, 4, 5 can be explained by some independent variable xjs.

*C. Data Analysis*

Data were analysed with descriptive statistics and econometric estimation procedures using STATA. Data were analysed using the multinomial regression model. The basic multivariate model to test the effects of socio-economic, institutional and technological variables on women labour utilization in staple crops value chains (clearing, cultivation, planting, weeding compared to post-harvesting) is stated as:

$Z_1=F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}) + \mu$ (12)
$Z_2=F(X_1, X_2, X_3, X_4, X_5, X_6, X_7 X_8, X_9, X_{10}, X_{11}) + \mu$ (13)
$Z_3=F(X_1, X_2, X_3, X_4, X_5, X_6, X_7 X_8, X_9, X_{10}, X_{11}) + \mu$ (14)
$Z_4=F(X_1, X_2, X_3, X_4, X_5, X_6, X_7 X_8, X_9, X_{10}, X_{11}) + \mu$ (15)
$Z_5=F(X_1, X_2, X_3, X_4, X_5, X_6, X_7 X_8, X_9, X_{10}, X_{11}) + \mu$ (16)

Where
$X_1$ = Active adult members (AAM) (No. of members)
$X_2$ = Levels of education (EDU) (in years);
$X_3$ = Use of hired Labor (HL) (0 or 1)
$X_4$ = Head of household (HHH)(farming =1, otherwise 0)
$X_5$ = Credit use (CA) (in ₦)
$X_6$ = Fertilizer use (FA) (in kg)
$X_7$ = Knowledge of extension agents (EXS) (0 or 1)
$X_8$ = Use of agrochemicals (AGC) (0 or 1)
$X_9$ = Distance to market (MRD) (in km)
$X_{10}$ = Age of women farmers (AGE) (in years)
$X_{11}$ = Distance to Asphalt road (ARD) (in km)
$X_{12}$ = μ = error term

The justification for the inclusion of these variables is as follows. Active adult member is the number of household members that could participate in staple crops value chains. This variable is very important in facilitating engagement of women in more rewarding and off-farm operation such as post-harvesting against other less rewarding on farm operations such as clearing, cultivation, planting and weeding. If there are many adult men and women in the household, the value chains activities in clearing, cultivation, weeding, and planting is shared among them and the women's labor engagements will be more likely to be utilized for post-harvesting against clearing, cultivation, planting and weeding.

Education was found to be negatively related to the engagement of women labor in less rewarding on farm operations such as clearing, cultivation, planting and weeding but positively related to the more rewarding post-harvesting (Iweagu, 2012) and the study showed that a unit increase in education decreases the probability that a woman would utilize her labor for less rewarding farm operations by about 2.82. This could only be explained by the fact that most educated women may be engaged in more rewarding economic activities to enable them to earn more income to hire labor for less rewarding farm operations such as clearing, cultivation, planting, weeding while engaging her labor in more rewarding post-harvesting including processing, storage, marketing to increase income and food security.

The primary occupation of women plays vital roles in determining their participation in on-farm and off-farm staple crop value chains activities. Full-time women farmers will likely engage in various farm operations than part-time women farmers that are also civil servants or those engaged in other occupations and thus positively engage in the clearing, cultivation, weeding and planting against post-harvesting.

Another key question of interest is whether women's labor engagement in off-farm post-harvesting is related to the use of credit and other inputs such as fertilizer, herbicides, pesticides, market and contact with extension education. Credit and other inputs are vital variables in determining the technology and output of value chains. It is expected that women with access to credit and other inputs will more likely encourage women to engage in more rewarding off-

farm post-harvesting compared to engagement in on-farm operations such as clearing, cultivation, planting, and weeding. Access to credit has a significant positive impact on female labor utilization in post-harvest operation in a research carried out by (Opata & Arua, 2017).

Female-headed households are likely to participate in less rewarding farm operations than male-headed households. The women head may not be married or that she is widowed, separated or divorced and the management decision is on her. She may not have the facilities to engage in post-harvesting compared to less rewarding clearing, cultivation, planting, and weeding.

Female farmers' age is used to account for her experience and its consequent influence in her utilization of labor where the results in the literature are mixed. Although (Zanello, 2012) conclude that older farmers tend to participate in more rewarding staple crop value chain activities due to their experience in farming compared with the younger peers in Ghana, (Xaba & Masuku, 2012) conclude otherwise for Swaziland. The distances of farmland from the house will also determine whether women will be engaged in off-farm post-harvesting or not. It is expected that women's labor will be engaged in less rewarding on farm operations on farmland closer to their houses than if the farm is located far from their houses. Surprisingly (Dommati & Chittedi, 2011) reported that farm located near the household might increase the tendency for women's labor to be utilized in more rewarding post-harvesting including processing, storage marketing and thus reduce (hence negative effects) for women labor to be utilized for less rewarding farm operations. The opinion of the women farmers as regards the constraints was measured with Likert-scale.

## IV. RESULTS AND DISCUSSION

### *A. Description of the Socio-Economic Characteristics of Respondents*

From the information provided in Table I the variables that characterized the socio-economic factors of the sampled households in the study sites were described. Households' farm operation's choices are varyingly influenced by these socioeconomic variables and other technological and institutional variables. The Table described the age, educational level, marital status of household head, household size, access to credit, farm distance from home.

*Age:* The frequency distribution of respondents according to age is shown in Table I. We see that the majority of the female respondents fall within the age of 41-60 years indicating that there was a relatively high proportion of middle-aged and old farmers in the villages engaged in agriculture. Female labor force participation by age in Nigeria showed that 76.5% of the total labor force falls below 30 years while 21.7% of the total labor force was 30-64 years.

TABLE I DESCRIPTION OF SOCIO-ECONOMIC CHARACTERISTICS OF FEMALE RESPONDENTS

| Characteristics | Women (N= 420) |
|---|---|
| **Age Range** | |
| 21- 30 years | 44 (11) |
| 31- 40 years | 68 (17) |
| 41- 50 years | 144(36) |
| 51- 60 years | 108(27) |
| >60 years | 36(9) |
| Total | 400(100) |
| **Educational Level** | |
| No formal Education | 180 (45) |
| Primary education | 140(35) |
| Secondary Education | 60(15) |
| Tertiary Education | 20(5) |
| Total | 400(100) |
| **Marital Status** | |
| Single | 8(2) |
| Married | 276(69) |
| Separated/divorced | 28(7) |
| Widowed | 88(22) |
| Total | 400(100) |
| **Household Size** | |
| 1-4 | 80(20) |
| 5-8 | 232(58) |
| 9-12 | 72(18) |
| >12<br>Total | 16(4)<br>400(100) |
| **The Proportion Of Income From Crop** | |
| < 25% | 104 (26) |
| 26- 50% | 80 (20) |
| 51- 75% | 140(35) |
| 100% | 76(19) |
| **Farm Distance In Km From Home** | |
| <1-3 | 280 (70) |
| 4-6 | 76(19) |
| 7-9 | 36(9) |
| >9 | 8(2) |
| **Status In Farming** | |
| Part-time | 140(35) |
| Full time | 260(65) |
| Total | 400(100) |
| **Access To Credit** | |
| 0 | 304(76) |
| 151,000 – 200,000 | 48(12) |
| >200,000 | 48(12) |

Figures in parentheses are percentages

Education influences women's participation in crop production. The more educated women are better employed and do not participate actively in farming. The frequency distribution of respondents according to educational attainment is shown in Table I. We see that 45% of the women never went to school at all.

Majorities (69%) of the women respondents were married, 22% were widows and 7% were separated/divorced. In southeast Nigeria women depended on their husbands for land and farm inputs for all their farming activities. In the absence of a woman's husband the extended family shift the responsibility to the woman by giving her the social and emotional support in her farm business (Enete & Amusa, 2010). This implied that women whether married, widowed or separated still received one type of help or the other from either their husbands or members of their families.

In this work, a household represents the occupants of a house which is regarded as a unit and is eating from the same pot Table I. The household size in the area ranged from 1-15 persons. The majority of the respondents (58 % had a household size of between 5-8 persons). The average of the household size is 7 persons. This suggests that the majority of households in the area had a large family size and the women may need to work harder in order to maintain the large family. Table I showed that most of the women farmers interviewed (65%) invariably had farming as their primary occupation and spent a greater portion of their time on it.

The remaining 35 % who combined farming with other occupations as mentioned in Table I realized one quarter or less of their income from farming. This result shows that full-time farmers depended so much on their farming activities as their main source of income. It was also observed that the part-time farmers realized a greater proportion of their income from non- farm activities. They did farm work only when they had satisfied the demands of their non-farm occupations. The result showed that the highest proportion (76 %) of the women farmers had no access to credit. It was only 12% that accessed more than ₦200,000 while 12% accessed between ₦151,000 and ₦200,000. This suggests that most women have no access to credit.

*B. Results of Multi Nominal Log it Regression Model*

This section presents the results of the multinomial logistic model and discusses the results of significant variables that determine female labor utilization in different staple crops value chains activities in South-East Nigeria. The variables in Table II were considered and tested for their significance. The multinomial logistic results of land clearing (step 1), cultivation (step 2), planting (step 3), weeding (step 4) and post-harvesting (step 5) was presented in Table II. The tables show the estimated coefficients (β values), standard error, and significant values (P) of the independent variables in the model.

*1. Diagnostic Test for Multinomial Logit and Correlation Coefficient of Some Variables*

Before subjecting data for multinomial logit analysis several econometric issues needed to be addressed prior to estimation. The multiple correlations among the independent variables and each of the five staple crop value chains activities (dependent variables) were examined to find out those variables that are highly correlated or not correlated with each of the dependent variables. This eliminated the potential of autocorrelation among the dependent and explanatory variables.

An analysis of the variance inflation factor (VIF) did not also show any problem. The use of Multi Nominal Logit Model should be based on the independence of irrelevance attributes (IIA). A critical assumption of Multi Nominal Logit Model is that the error term in estimating the choice probability for individual i (post-harvesting) for alternative j (clearing) is independent of the error term in estimating the choice probability for individual i (post-harvesting) for alternative k (cultivation). This means that the alternative facing the individual should sufficiently be different from each other.

For example, IIA requires that in comparing alternatives clearing and cultivation, the other alternative are irrelevant. Thus a Hausman's specification was carried out to test for the validity of the IIA which is based on the fact that if a choice set is irrelevant, eliminating a choice from the model altogether will not change parameter estimate systematically and the results showed no evidence that the study did not meet IIA assumption.

Therefore clearing, cultivation, planting, weeding, and post-harvesting are sufficiently different from each other. The on-farm and off-farm operations are unbiased and consistent parameter estimates. Specifically, the likelihood of women's labor to be utilized in post-harvesting is independent of other alternatives such as clearing, cultivation, planting, and weeding.

*2. Socio-Economic, Institutional and Technical Factors Affecting the Women's Labor Utilization in Different Farm Operations*

The marginal effects of the multinomial logistic regression model are presented in Table II. Women labor engagements choice on clearing or cultivation or planting or weeding or post-harvesting depend on socio-economic, institutional and technological factors.

The estimated coefficients (β values) measure the expected change in the logit for a unit change in each independent variable, all other independent variables being constant. The sign of the coefficient shows the direction of influence of the variable on the logit. It follows that a positive value indicates an increase in the likelihood that a household will change to the alternative option for the baseline group.

TABLE II (a) RESULT OF MULTINOMINAL LOGIT MODEL ANALYSIS OF WOMEN LABOR UTILIZATION IN CLEARING, CULTIVATION, PLANTING, WEEDING, AND POST-HARVESTING

| Variables | (Clearing 1) | | | (Cultivation 2) | | |
|---|---|---|---|---|---|---|
| | Coef. | Std. error | Sig (p) | Coef. | Std err | Sig (p) |
| AGE | 0.16733 | 0.82766 | NS | -.0345489 | .0883651 | 0.696 |
| HL | -50.29594 | 1.35e+09 | 1.000 | -44.36659 | 1.53e+09 | 1.000 |
| EDU | -.3110898 | 0.1860933 | 0.257 | -.0398975 | .0806156 | 0.621 |
| EXS | -.4909272 | 1.704001 | 0.773 | 1. 289409 | 1.042368 | 0.216 |
| CA | -.0222996 | 0.0077701 | 0.003*** | -.0999755 | .0003928 | 0.013** |
| MRD | -.0311659 | 0.006167 | 0.034** | -.000281 | .0003055 | 0.358 |
| FA | -0011654 | 0.0066501 | 0.003*** | -.0001533 | .0001251 | 0.345 |
| AGC | -.1418745 | 0.0565432 | 0.003*** | -.0342453 | .0001321 | 0.002*** |
| HHH | -.0312786 | 0.045432 | 0.009*** | -.0532453 | 0.017842 | 0.022** |
| AAM | -.03880 | 0.3567 | 0.039** | -.1589342 | 0.095641 | 0.044** |
| ARD | -0.037099 | 0.5328932 | 0.043** | -.2378609 | 0.564321 | 0.036** |
| Cons | 29.38213 | 11.04304 | 0.0011 | 6.271686 | 5.595692 | 0.262 |

Statistics $Chi^2$ = 71; Prob. > $Chi^2$ < 0.001; Pseudo $R^2$ = 0.859. No of obs. = 400

TABLE II (b)

| Variables | Planting 3 | | | Weeding 4 | | |
|---|---|---|---|---|---|---|
| | Coef. | Std. error | Sig (p) | Coef. | Std err | Sig (p) |
| AGE | -16.77639 | .1685738 | 0.011 ** | -.0356422 | .0345651 | 0.696 |
| HL | .29594 | .002356 | 0.001*** | -.023567 | .001234 | 0.004*** |
| EDU | .0311089 | 0.000933 | 0.057* | -.098763 | .0342675 | 0.621 |
| EXS | .425554 | 1.704001 | 0.773 | 1. 28452 | 1.324658 | 0.216 |
| CA | .266996 | 0.0077701 | 0.003*** | -.055489 | .0003928 | 0.013** |
| MRD | .165922 | 0.006167 | 0.778 | -.005681 | .0043261 | 0.358 |
| FA | -43.42289 | 8.80e+08 | 1.000 | -4.337626 | 8.90e+08 | 3.222 |
| AGC | .001165 | 0.0066501 | 0.798 | -.0001533 | .0005436 | 0.345 |
| HHH | .032189 | 0.0236543 | 0.002*** | .0342453 | .0003421 | 0.003*** |
| AAM | .0314571 | 0.003256 | 0.007*** | .0123245 | 0.017842 | 0.022** |
| ARD | .7910506 | 0.183245 | 0.035** | -.0432710 | 0.01453 | 0.046** |
| Cons | 1.970991 | 0.893222 | 0.036** | .3245122 | 0.23143 | 0.031** |
| | 21.05641 | 7.9043041 | 0.008 | 6.325432 | 4.34257 | 0.089 |

Statistics Chi2 = 71; Prob. > Chi2 < 0.001; Pseudo R2 = 0.859. No of obs. = 400

A negative value shows that it is less likely that a household will consider the alternative to baseline. Therefore, in this study, a positive coefficient value in clearing implies an increase in the likelihood of remaining in clearing compared to post-harvesting (baseline). The significant values (also known as P-value) show whether a change in the independent variable significantly influences the logit at a given level. In this study, the variables were tested at 1% 5% and 10% significant levels. Thus, if the significant value is greater than 0.01, 0.05 and 0.1, then it shows that there is insufficient evidence to support the claim that the independent variable influences a change away from the baseline activity. If the significant value is equal or less than 0.01, 0.05 and 0.1, then there is enough evidence to support a claim presented by the coefficient value. The standard error in the value measures the standard deviation of the error in the value of a given variable.

As indicated in Table II, some predictor variables influenced women labor utilization in staple crops values chains activities significantly. Of the 11 independent variables used in the model, 7 variables in the clearing, 5 variables in cultivation, 8 variable in planting and 5 variables in weeding are statistically significant at 1%, 5% and 10% significant levels.

Younger women's farmers were found moving to post-harvesting compared to planting and a year decrease in age increases the propensity to engage in post-harvesting operations by 16 percent. Active adult members increase the propensity of women labor engagements' in post-harvesting farm operations against less rewarding farm operations such as clearing, cultivation, planting, and weeding. Technical factors such as the use of fertilizers, credit, agrochemicals were all found to increase the propensity of women labor engagements in more rewarding post-harvesting compared to less rewarding clearing, cultivation, and planting. Being a women head of household positively affected women engagement in planting and weeding. The coefficient of planting was 3 percent and significant at 1 per cent, while the coefficient of weeding was 3 percent and also significant at 1 percent. The result agrees with (Enete & Amusa, 2010) who observed that female-headed households engage in planting and weeding farm operations to sustain their households.

Distance to asphalt road negatively and significantly affected women's labor engagement in clearing with a coefficient of 3.7 percent which is significant at 1per cent probability level, and in weeding with a coefficient of 4 percent and also significant at 1 percent. This implies that

women being one kilometer further away from the asphalt road will increase their propensity to engage in post-harvesting value chains compared to clearing and weeding. Fapohunda, (2012) reported that about 70% of the economically active women population is involved in post-harvest value chains such as threshing, shelling, handling, winnowing, processing, storage, transportation, and marketing. Distance to farm negatively and significantly affected the women labor engagement in the clearing. One kilometer further away from home will increase the propensity to engage in the clearing by 3 percent and significant at 5 percent.

Institutional factor such as use of credit had a negatively and significant effect on propensity for women labor to be engaged in clearing compared with post-harvesting at a coefficient of 2 per cent and significant at 1% probability level; while cultivation has a coefficient of 9 percent at 5 percent significant level as shown in Table II. Therefore, the null hypothesis which states that the socio-economic, institutional and technical factors have no significant effect in women labor engagement in staple crops value chains activities was rejected.

Women devote a much larger share of their labor time to staple crops value chains activities and thus regarded as current managers of this sector. Factors affecting women labor utilization in staple crop value chains activities were adult members which had negative and significant influence for use of hours of women labor in on-farm operations compared to post-harvesting; headship position had positive and significant influence, access to credit and education had negative and significant influence. The $R^2$ value of the model is 0.76 implying that the independent variables in the model explained only 76 percent of the variability in different farm operations engaging women labor in clearing, cultivation, planting, weeding against harvesting in southeast Nigeria.

*C. The Constraint Militating Against Women's Labor Utilization in Staple Crop Value Chain Activities.*

The opinion of the women farmers as regards the constraints was measured with Likert-scale.

Likert-type scale of a 4 point was adopted and graded as very serious = 4, serious = 3, not very serious = 2 and not serious = 1.

Based on this grading, the levels of constraints facing women farmers were ranked using a weighted mean. The mean score (MS) of respondents based on the point scale is 4+3+2+1 = 10/4 = 2.5. Using the interval scale of 0.05, the upper limit cut off point was 2.5+0.05 = 2.55; the lower limit was 2.5-0.05 =2.45. Then, any mean score (MS) below 2.45, was ranked as “not serious, and not very serious” while between 2.45 and 2.55 were considered as “serious”, while any greater than or equal to 2.55 was considered as “very serious” problems to farmers (Opata, Nweze, Ezeibe, & Mallam, 2018).

Table III below shows that 17 out of 20 constraints mentioned above were regarded as very serious problems. Their mean values were above the set criteria of 2.50. Lack of finance was the most serious problem with the mean value of 4.00.

TABLE III DISTRIBUTION OF RESPONDENTS ACCORDING TO CONSTRAINTS IDENTIFIED

| Constants | F | X | SD | Decision |
|---|---|---|---|---|
| Lack of finance | 400 | 4.00 | 0.4 | VS |
| Lack of extension services | 248 | 2.50 | 2.0 | VS |
| Lack of inputs | 288 | 2.90 | 1.8 | VS |
| Lack of storage facilities | 300 | 2.90 | 1.8 | VS |
| Lack of credit and loan | 388 | 3.90 | 0.5 | VS |
| Lack of infrastructure | 300 | 3.00 | 1.0 | VS |
| Negative attitude of women | 180 | 1.80 | 2.6 | NS |
| Illiteracy | 208 | 2.10 | 2.2 | NS |
| Pest and disease | 280 | 2.80 | 1.9 | VS |
| The high cost of labor | 284 | 2.83 | 1.9 | VS |
| Transportation problem | 264 | 2.65 | 2.0 | VS |
| Land tenure problem | 264 | 2.65 | 2.0 | VS |
| Low motivation | 100 | 1.0 | 2.9 | NS |
| The poor and seasonal road network | 256 | 2.60 | 2.0 | VS |
| Price fluctuation of produce | 316 | 3.20 | 0.8 | VS |
| Difficulty in marketing produce | 308 | 3.10 | 0.9 | VS |
| High spoilage | 340 | 3.40 | 0.7 | VS |
| The tediousness of most farm operations | 284 | 2.65 | 2.0 | VS |
| Lack of mechanization of farm operations | 244 | 2.50 | 1.8 | VS |
| Small sized farm plots | 380 | 3.80 | 0.6 | VS |

Other farm constraints viewed very serious included lack of credit and loan (3.90), small sized farm plots (3.80), high spoilage (3.40), price fluctuation of produce(3.20), lack of infrastructure (3.00), lack of farm inputs and storage facilities (2.90), cost of labor (2.83), land tenure system and pest and disease (2.80), transportation problem and technology of most farm operation (2.65), lack of mechanization of farm operation and lack of extension service (2.50) were also perceived as serious problems militating against women's engagement in staple crop value chain activities. The result of the opinion of the women farmers as regards the problems they faced in crop production is presented in Table III.

Illiteracy, negative attitude of women and low motivation were not serious problems and the least was low motivation with a mean value of 1.0. Most of the respondents had their farm plots scattered at different locations within and outside the village. With the poor road networks and lack of means of transportation in the rural areas, the majority of the respondents spent much time and labor trekking and carrying products to and fro the farm.

Again, some of the respondents sold their farm products at a time they would not have loved to do so because they could not preserve them. Since most agricultural products are perishable items, without the necessary storage and preservative measures, some women farmers complained of deterioration and loss of the quantity of products when they made attempt to store them.

Another area the respondents expressed concern was the constant changes in the price of planting materials with the unit price of planting materials such as seed yams, rice, maize, okra, cassava cuttings among others increasing daily. Some of the respondents reported that they could no longer afford to buy them because of insufficient capital. They rather limit themselves to materials from previous farm work. It could be said then that all these staple crops value chains constraints identified affected productive capabilities of the respondents in southeast Nigeria.

## V. CONCLUSION

This study employ descriptive statistics and multinomial logit model on data collected from 400 randomly selected women farmers engaged in staple crop value chains activities in southeast Nigeria during 2016/17 crop year, and identified socioeconomic, institutional and technological factors affecting their engagements in on-farm and less rewarding staple crop value chain activities such as clearing, cultivation, planting, weeding compared to post harvesting in Southeast Nigeria. The aim is to determine factors that increase the propensity of women's engagement in more rewarding off-farm post harvesting in staple crop value chain activities which is linked to input and output marketing such as handing, threshing, shelling, winnowing, storage, processing and marketing compared with their engagement in less rewarding on-farm value chains activities in staple crop such as clearing, cultivation, planting and weeding. Multinomial logit results show that complementary input such as the use of credit, hired labor, fertilizers, agrochemicals, more land, adult men/women and extension services had a negative relationship with women's engagement in less rewarding farm operations. The constraint militating against women's labor utilization in staple crop value chain activities were lack of storage facilities, lack of credit, lack of improved input, poor road network and land tenure problems. The paper recommends institutional framework through extension education, technology-supply industries, financial institutions, improved road network could enhance women's labor engagement in more beneficial value chains activities such as post-harvest operations since women farmer selling to the market are more rewarding than engagement in clearing, cultivation, planting and weeding so that the intermediaries do not hamper food security.

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