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## **Young Rural Women Participation in the E-Wallet Programme and Usage Intensity of Modern Agricultural Inputs in Nigeria<sup>1</sup>**

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**Young Rural Women Participation in the E-Wallet Programme and Usage Intensity of Modern Agricultural Inputs in Nigeria**

**Joseph I. Uduji & Elda N. Okolo-Obasi**

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**Abstract**

We assess the extent young rural women (YRW) participate in the federal government (FGN)e-wallet programme and the subsequent impact on usage intensity of modern agricultural inputs in Nigeria. Six hundred YRW were sampled across six geopolitical zones of Nigeria. Using double-hurdle, results show that YRW rarely participate in the e-wallet programme due to the cultural and traditional context which is anchored in beliefs, norms and practices that breed discrimination and feminized poverty. This implies that Nigeria's agricultural transformation agenda would only succeed if the FGN is able to draw on all its resources and talents, and if the YRW can be able to participate fully in the e-wallet programme. This will require intensified efforts to eliminate discrimination and promote equalities. To bridge the gender gap, the federal ministry of agriculture and rural development should pay close attention to the extent the participation of unmarried girls and young women, including nursing mothers in the e-wallet programme, may be limited by the cultural and/or domestic and child care duties. The findings suggest that FGN should discourage gender disparities in unequal access to agricultural inputs and pervasive, inequality, especially over ownership of agricultural land that limit women's contribution to household food baskets.

*Keywords:* Gender, e-wallet programme, modern agricultural inputs, young rural women, double-hurdle model, Nigeria.

*JEL Classification:* J43; O40; O55; Q10

## Introduction

Gender disparities in income, access to health and educational attainment are pervasive across the continent of Africa. Women farmers are eight times less likely to independently own their own agricultural land and inputs (FAO/IFAD/ILO, 2010). Women with secondary education are 37 percent less likely to be employed in the formal, non-agricultural sectors (IFAD, 2010). In most of the countries, girls are less likely to be sent to school, irrespective of their ability, and their schooling is more likely to be disrupted (IDS, 2012). Even when girls achieve equal levels of education with their male counterparts, they have less chance of getting salaries jobs and are likely to be paid less (IFAD, 2013). According to African Development Report (2015) nearly 36 percent of African women report being victims of violence, mostly inflicted on them by their intimate partners, and the true prevalence of violence against women is likely to be grossly under-reported. As well as the direct impact on women and children, violence against women has wider social and economic consequences, including on infant and child nutritional and health outcomes (AFDB, 2015). It is likely that African countries could reduce violence against women through measures that address gender inequality in education and employment. With the agricultural sector employing two-thirds of the continent's workforce, concentrating investment in this sector has considerable potential for sustaining growth and reducing poverty.

In Nigeria, young rural women (YRW) are the major agricultural producers, and are active in trade and informal economy, but they continue to be hampered by lack of rights, resources and economic opportunities. Their participation in economic, political and social development is being held back by unequal access to resources and opportunities and unacceptable levels of interpersonal violence (Anyanwu *et al*, 2016). This causes both direct harm to rural women and children, and wider cost to the country's economy. Nigeria owes its women and girls a better deal for a targeted intervention to raise young women's economic status and to deter aggression, especially for this group who live in rural areas and work mainly in farms. An attempt to support its agricultural sector, the federal government of Nigeria (FGN) set to distribute agricultural inputs to farmers by mobile phones (e-wallet) as it awarded a ₦1.327 billion (US \$8 million) contract for a Growth Enhancement Support Scheme (GESS) in the country (Adesina, 2012). The e-wallet is at the heart of technology applications under the GESS. It is an ecosystem technology that ensures that a Nigerian farmer receives farm inputs subsidy support from government through accredited agro-dealers and provides vital agro-information alerts from agriculture extension system. Through the e-wallet, farmers will receive allocations of agricultural inputs by mobile phones SMS alert, thus eliminating corrupt

middle men grafted in the agricultural space (IFDC, 2013). The farmer who gets an allocation is getting a 50 percent subsidy, then collect the inputs from the agro-dealer in their village, and the transaction is completed with no money exchange with the middle men (Adesina, 2013). The programme was suspended in 2015 due to political conflicts of the old and new administration, but was reinstated in 2016 (FGN, 2017).

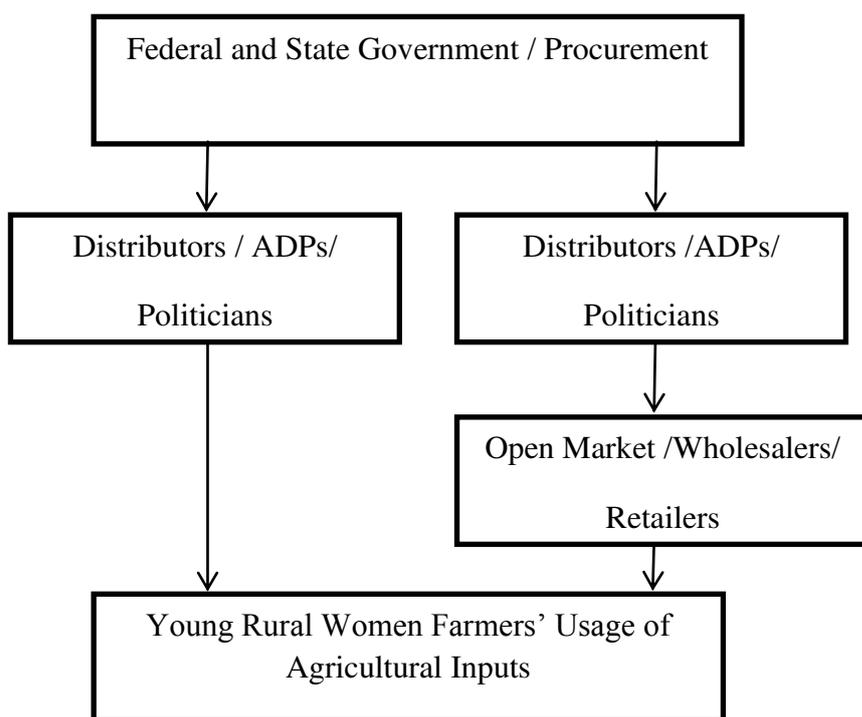
However, as a concept the e-wallet distribution model has been heavily criticized over its utility and practical implication in the rural areas. For example, academics such as Adebo (2014), Nwalieji *et al* (2015), Fadairo *et al* (2015), Trini *et al* (2014), Henri-Ukoha *et al* (2012), Eze (2013) and others have argue that e-wallet process in Nigeria is not far reaching or deeply entrenched in rural areas. Thus, it has been contended that the poor rural farmers are not benefiting in the absence of network connectivity and access to SIM and handsets in rural areas (Ibitoye *et al*, 2016). On the other hand, Grossman and Tarazi(2014), Olomola (2015), Liverpool-Tasie (2014), Awotide *et al* (2013), Akinboro (2014) support e-wallet initiative, arguing that it is making progress in some rural areas in Nigeria. To further elucidate these assertions, Olomola (2015) illustrates that the implementation of the e-wallet model is on a path of continuous improvement, and that the policy and strategic reforms in input subsidy delivery have yielded some of the federal government desired results. Thus, this paper contributes to the gender debate in agriculture from the e-wallet perspective by assessing the empirical evidence in two areas that has received much attention in the literature:

- i. What is the level of young rural women participation in the e-wallet programme in Nigeria?
- ii. Does e-wallet programme impact on young rural women's usage intensity of modern agricultural inputs in Nigeria?
- iii. What are the consequences of increase in intensity of use of modern agricultural inputs by young rural women in Nigeria?

The rest of the paper is structured as follows. Section 2 considers the essentials of modern agricultural inputs in Nigeria. Section 3 reviews the engagement of young rural women in agricultural production in Nigeria. Section 4 provides a succinct report of the Nigeria's growth enhancement support scheme. Section 5 provides the theoretical perspectives. Section 6 compared double-hurdle model with Tobit model for the analysis. Section 7 describes the methodology. Section 8 presents the empirical results. Section 9 provides the main findings and discussions. Section 10 concludes with policy implications.

### The Essentials of Modern Agricultural Inputs in Farm Production

Previous study on rice farming populations in the three major rice-growing regions in Nigeria, showed that in one farming season, the adoption of improved agricultural inputs and technology to rice farming, gave farmers a 358.89 kg/ha (approximately 9 percent) advantage over their peers who neither adopted improved inputs nor technology into farming processes (Awotide *et al*, 2012). In the case of cassava, of which Nigeria is the world’s largest producer, production costs could be reduced by 40 percent with the usage of improved varieties of stems and mechanization of planting and harvesting (IFAD, 1994). Agricultural inputs range from improved seeds, fertilizers and crop protection chemicals to machinery, irrigation and knowledge (World Bank, 2014). Seeds are critical to successful crop production and inevitably, farm productivity and profitability (Almekinder and Louwaars, 2012). Fertilizer supplies nutrients to the soil that are essential for growth (Gregory and Bumb, 2006). Increased use of fertilizer and improved seeds are partially credited with the large increases in agricultural productivity growth in Asia during the Green Revolution in the 1960s (Keyer *et al*, 2015). Irrigation is also essential for growth as it enables off-season farming, provides the potential for multiple harvests per year, and brings additional land under cultivation (Adeoti, 2012). Crop protection chemicals (pesticides, herbicides, insecticides and fungicides) control weed species, harmful insects and plant diseases that afflict crops (Oerke and Dehne, 2004). Finally, technical knowledge and machinery enhance human labour effectiveness and increase farm productivity (Akinbamowo, 2013). Figure 1 shows the previous channels for modern agricultural inputs to rural farmers in Nigeria.



**Figure 1.** Previous Distribution Channels for Modern Agricultural Inputs.

*Source:* Authors' Illustration

### **The Engagement of Young Rural Women in Agricultural Production**

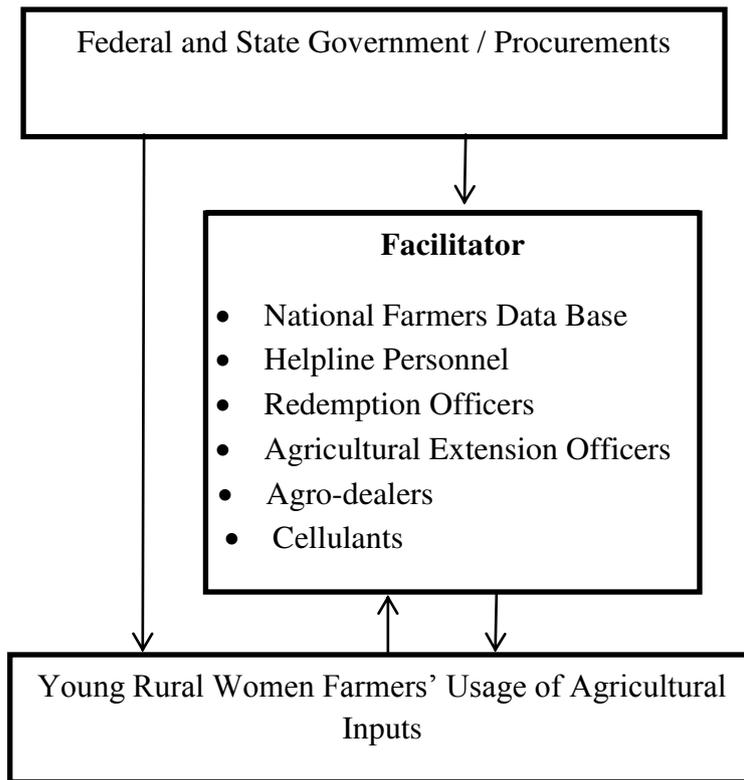
In Nigeria, women have established more roles in agricultural production, processing and utilization. A women's role in the agricultural sector is significantly affected by socio-economic factors such as income, education, access to inputs and infrastructure (Kelly *et al*, 2004). Though women constitute about 75 percent of the farming population in Nigeria, working as small scale farm managers and suppliers of labour, their possibilities in agriculture appear to be hindered by formal traditional rules in rural areas (FMARD, 2010; Palacios-Lopez *et al*, 2015). In order for agriculture and rural development to advance in Nigeria, gender specific policies and services tailored to rural women in the value chains could be imperative (Takeshima and Nkonya, 2014).

The extent of gender involvement in agricultural production varies across ethnic groups in Nigeria. Generally, rural women farmers in Nigeria work alongside with their male counter parts with some clear distinctions in activities between them (Uduji and Okolo-Obasi, 2016). In most cases, the men execute the tedious tasks such as land clearing and felling of trees, gathering and burning of bush, and making ridges, while the women engage in planting (Eze, 2013). Most importantly, women also participate in weeding, harvesting, and on-farm processing, and selling of farm produce (Nwalieji *et al*, 2015). However, women are rarely involved in agricultural export crops such as cocoa, rubber, cotton, but are engaged with the production of food crops such as maize, cowpea, melon, pepper, cassava, and vegetables (Ibitoye *et al*, 2016). In some cases, women participate in small scale animal production including small ruminants, poultry and aqua-culture (Henri-Ukoha *et al*, 2012). However, in 2003 community-based Agriculture and Rural Development (CBARDP) was launched in Nigeria with the main objective of improving the living conditions of the rural poor with an emphasis on rural women (FMARD, 2010). The programme was jointly funded by the International Fund for Agricultural Development (IFAD) and the federal government of Nigeria, with a focus on eight participating states namely: Borno, Jigawa, Kano, Katsina, Kebbi, Yobe and Zamfara (Takeshima and Nkoya, 2014). Through the CBARDP women farmers were empowered through improved farming practices that increased yield and family income in rural areas. The programme also created employment opportunities for rural women and small scale entrepreneurs in the country (Uduji and Okolo-Obasi, 2016; Palacios-Lopez *et al*, 2015; Sofa team and DOSS, 2011).

## **The Nigeria's Growth Enhancement Support Scheme**

In 2012, the federal government of Nigeria launched the Growth Enhancement Support Scheme (GESS) to transform the delivery of agricultural input subsidies in the country. Thus, GESS is a shift from the previous input market stabilization programme to a new scheme that puts resource – constrained farmers at the center of input subsidy policy (Olomola, 2015). The scheme delivers agricultural inputs to farmers through an electronic wallets (e-wallet), in which farmers use unique coded numbers that are delivered to their mobile phones to redeem at 50 percent discount from accredited agro-dealers in the rural villages (Adesina, 2012). Figure 2 shows the present e-wallet model for distribution of modern agricultural inputs in rural areas in Nigeria.

Under the GESS, state and local governments are responsible for registering eligible smallholder farmers (a farmer with five or fewer hectares of farmlands). Farmers manually fill out a machine-readable form, data are processed and captured in a national database, and farmers receive a unique GESS ID number (Adebo, 2014). If farmers have access to a mobile phone, their phone numbers are recorded during registration, and the system sends to them periodic messages confirming their registration and notifying them of when and where to go to redeem their subsidy (Akinboro, 2014). Registered farmers with mobile phones redeem subsidies using their own phones, while those without phones can use another phones to do so (Adesina, 2012). The GESS assigns a certain sum of subsidy credit to each farmer; these credits are associated with the farmer's GESS ID number and if applicable, the farmer's mobile phone number. In either case, no funds are directly transferred to the farmers, so farmers may use the service without registering for a mobile wallet (Akinboro, 2014). Registered farmers with phones receive an SMS message that they have been allocated subsidy and can visit the local agro-dealer redemption center to collect their inputs (Olomola, 2015). Registered farmers without phones will realize that it is time to redeem subsidies when other farmers within the community receive the SMS messages (Uduji and Okolo-Obasi, 2016). At the redemption center, farmers pay the 50 percent balance and collect subsidies by sending SMS to the center platform requesting authorization of subsidy redemption (Trin *et al*, 2014). Farmers who did not provide a mobile phone when registering for the service can conduct the transaction by using a phone available at the redemption center and supplying their GESS ID number (Adebo, 2014). If the transaction is successful, both the farmer and the agro-dealer receive confirmation messages authorizing the subsidy redemption. In 2013, federal government reach 4.3 million smallholders with estimating cost of about ₦12 billion (approximately US \$96 million) at ₦3000 cost per smallholder receiving subsidy which is equivalent of US \$25 (Olomola, 2015). This scheme is largely managed by Cellulant Nigeria Limited, a technology company licensed as a mobile payment service provider.



**Figure 2.** Present E-Wallet Model for Distribution of Modern Agricultural Inputs.

*Source:* Authors' Illustration

Quite a number of other studies have analyzed the concept of mobile phone initiatives on farmers' agricultural education and extension in developing countries. They include: Aker (2008, 2010, 2011), Furuholt and Matotay (2011), Mittal and Tripathic (2009), Labonne and Chase (2009), Mittal and Mehar (2012, 2016) Aker and Mbitti (2010), Kirui (2013), Lee and Bellemare (2013), Duncombe and Boatang (2009), etc. However, extant literature lacks approach from women farmers' education, extension contact and usage of agricultural inputs. This study further differs from extant literature by explicitly noting the relationship that exists between e-wallet model and women farmers' use of agricultural inputs in rural areas in Nigeria. Table 1 shows the strength and limitations of the federal government e-wallet system in Nigeria.

**Table 1.**E-wallet Model: Strengths and Limitations

strengths	limitations
1. It is intended to benefit the grassroots small scale farmers in Nigeria.	1. Limited mobile phone network coverage in rural areas in Nigeria could hinder redemption of allocated inputs.
2. It provides direct linkage between the farmers and the government for easy information dissemination.	2. Most of the upstream suppliers of agro-inputs may not have a national network of agro-dealers that can be relied upon for effective delivery of agro-inputs to every local government area (LGA) and ward in Nigeria.
3. It is intended to bring a degree of sanity to agricultural input markets in Nigeria.	3. Most of the participating rural poor farmers may not have the small financial capacity to redeem the allocated agricultural inputs.
4. It is aimed at reducing corruption and ensuring that subsidized inputs are delivered to the intended smallholders.	4. The poor rural electrification in Nigeria could hinder supply of power in redemption centers.
5. The use of mobile phone to delivery services to small scale farmers shortens the protocol to access agricultural inputs in Nigeria.	5. Lack of agricultural extension personnel may hinder knowledge of agricultural inputs usage in the rural areas in Nigeria.
6. It has potential to boost agricultural production and accelerate achievement of national food security programme in Nigeria	6. The rural poor farmers may not know how to use mobile handset effectively for voucher payments.

**Source:** Authors' Compilation

### **The Theoretical Perspectives**

The concept of gender, as opposed to sex, wasn't introduced until the 1970s. Robert Stoller, a psychologist who worked with individuals born with ambiguous genitalia, was the first to point out a distinction between sex and gender. He posited four concepts: sex, gender, gender identity and gender role (Stoller, 1964, 1968). Although the term 'gender role' soon faded from view in feminist

circles, Stoller's other three concepts were quickly appropriated by feminists. From the 1970s onwards, there are much attention discussion about sex and gender, and whether men and women's bodies have natural differences that pre-determine a specific gender, which in turn leads to a corresponding sexuality. Since the 1980s, there has been a proliferation of women's and gender research in Africa (Ampofo *et al*, 2004). This growth can be attributed to several factors such as the global north women's movement, the influence of the women and development industry, the national political and economic conditions, the crisis in African educating and the emergence of state feminism (Mama, 1996). Prior to this period, in the 1950s and 1960s, women were linked to nationalist struggles for independence. In addition, gender, race, and class relations were already integral to struggles African women were engaged in when compared to their counterparts in the global north, who only began to acknowledge the centrality of these issues in the 1980s (Lewis, 2002).

Current approaches to study of women and gender in Africa are rooted in African feminist as opposed to global north feminist ethnographies and theories. African gender studies scholars are conversant with postmodernist discourses on difference, stressing the need to generate systematic evidence around issues that unify and create space for dialogue rather than confrontation and differences (Nzomo, 1998; Ampofo *et al*, 2008). This paper seeks to use African gender conceptualization as a framework for descriptive analysis of young rural women participation in the e-wallet programme and usage intensity of modern agricultural inputs in Nigeria. This is predicated from the perspective that Africa's growth and development agenda can only succeed if the continent is able to draw on all its resources and talents, and if women are able to participate fully in economic, social and political life; which will require intensified efforts to eliminate discrimination and promote equal rights.

### **The Double-Hurdle Model versus Tobit Model**

In modelling the behavior of human being, especially when it comes to adoption and usage of innovations, Gebremedhin and Swinton (2003) argue that the two decisions of adopting and using of a new innovation by any would be adopter(s) (say, young rural women in the case at hand) could be made jointly or separately. In the studies of innovation adoption and usage, there is always a probability of recording zero participation. For this reason, the Tobit model which is an extension of probit model has always been used to analyze adoption with the assumption that the two decisions are affected by the same set of factors (Tobin, 1958). This has been described as an approach to deal

with the problem of censored data (Johnson and Dinardo, 1997). However, scholars, such as Garcia (2013), Beshir *et al* (2012), and Eakins (2014) argue that Tobit model is very restrictive in its parameterization because of the assumption that the two decisions are affected by the same factors. Also, Arabmazar and Schmid (1982) argue that empirical results obtained with Tobit model often are not robust across distribution assumptions. The specification of an appropriate model could depend on the phenomenon that is assumed to give rise to the zeros. Therefore in the case of taking decision to participate in the e-wallet programme and the subsequent usage intensity of modern Agricultural inputs, the Tobit model assumes that zero participation are observed when desired participation is not positive, hence truncating the dependent variable at zero.

However, Cragg (1971) provided another explanation to this by accepting that one may desire a positive participation but some other factors may effectively hinder the participation. Cragg argued that different factors may influence each of the two processes contrary to the assumption of the Tobit model. To this, Cragg proposed the “double hurdle” model which is more flexible parameterization than the Tobit model. The double-hurdle model is a parametric generalization of the Tobit model, in which two separate stochastic processes determine the decision to adopt and the level of adoption technology. In so many empirical studies, such as Akinbode and Dipeolu (2012), Rossini *et al*, (2015), double-hurdle model has been used to achieve robust results. In this study, the double-hurdle model is based on the assumption that, participation in the e-wallet programme and usage intensity of modern agricultural inputs are two distinct or independent decisions to make. The model assumes that young rural women farmers make two subsequent decisions with regard to participating in the government e-wallet programme, and adoption and usage intensity of the modern agricultural inputs. The two-stage decision nature implies that participation and adoption of the innovation should be modeled jointly to partly gain estimation efficiency. The advantage of the double-hurdle model compared with the standard univariate Tobit model for this study is that it provides a more flexible framework to model the observed young rural women farmers’ behavior as a joint choice of the two decisions instead of a single decision.

## **Methodology**

This study adopts quantitative methodology, as a contribution given the paucity of quantitative works on e-wallet system technology under the Growth Enhancement Support Scheme in the Region as pointed out by Olomola, (2015); Grossman and Tarazi, (2014) and Adebo, (2014). The study adopted survey research technique with the aims of gathering information from a representative sample of the population. It is essentially cross-sectional that describes and interprets what exists at present.

### **Study Area**

The study area comprises the six geopolitical zones in Nigeria. They are: North-West, North- East, North-Central, South-West, South-East, and South-South geopolitical zones. Although region differences in the perception of young women varies significantly in parts of the world; in the context of Nigeria, a girl becomes a women on the day she marries, and regardless of how young she is (IDS, 2012).However, in this study, young women are defined as a diverse group ranging from young school girls to young married women and nursing mothers. Table 2 shows the study population of the young rural women in six geopolitical zones of Nigeria.

**Table 2.**The Study Population

<b>Selected States (Geopolitical zones)</b>	<b>Male</b>	<b>Female</b>	<b>Total Population</b>	<b>Population of Young rural women farmers</b>
Adamawa (North- East)	1,607,270	1,571,680	3,178,950	471,504
Benue (North-Central)	2,114,043	2,109,598	4,223,641	632,879
Cross River (South-South)	1,471,967	1,421,021	2,892,988	426,306
Ebonyi (South-East)	1,064,156	1,112,791	2,176,947	333,837
Ekiti (South-West)	1,215,487	1,183,470	2,398,957	355,041
Kano (North-West)	4,947,952	4,453,336	9,401,288	1,336,001
<b>Total</b>	<b>12,420,875</b>	<b>11,851,896</b>	<b>24,272,771</b>	<b>3,555,569</b>

Source: FMARD, 2010

### **Sample Size**

The z-score sampling technique postulated by Smith, (2013) was used to obtain a sample size of 600 young rural women farmer in Nigeria as shown below.

$$\text{Sample size} = (z)^2 \times \text{std}(1-\text{std}) / (\text{mr})^2 \quad \text{equation 1}$$

Where z = z-score = confidence level

Std = standard deviation

mr = margin of error = confidence interval

1 = constant

We therefore chose a confidence level of 90%, margin of error of 5% and a standard deviation of 0.5. Substituting the values in our equation, we have

z-score @ 90% confidence level = 1.645 (z-score table) and thus

$$\text{sample size} = (1.645)^2 \times 0.5(1-0.5)/(0.05)^2$$

$$= 0.6765/(0.05)^2$$

$$= 0.6765/0.0025$$

$$= 270.60$$

This was approximated to 300 and was later doubled to further minimize the possible errors in the sample selection. Hence a total sample unit chosen was 600 respondents.

### ***Sampling Procedure***

To make for good responses in the study, multi-stage probability involving both cluster and simple random samplings was used to select the respondent for the study. In the first stage, to ensure that the population is adequately represented, the states were clustered according to the six geopolitical zones of north-east, north-central, north-west, south-east, south-south and south-west. In stage two, a purposive sampling was used to select one state from each of the six clusters (geopolitical zones) based on the intensity of agricultural practices in the states as follows: Benue state (north-central), Adamawa State (north-east), Kano state (north-west), Ebonyi state (south-east), Cross Rivers state (south-south), and Ekiti state (south-west). In stage three, all the local government areas (LGAs) in each of the selected states were listed and using simple random sampling, two LGAs were selected from each state, giving a total of eighteen (12) LGAs for the study. In the fourth stage, to ensure proper representation, the main communities in the selected LGAs were listed and three communities were randomly selected from each LGA giving a total of thirty six rural farming communities for the study. In the last stage, out of the Thirty six communities selected, with the help of the traditional and community leaders, six hundred (600) respondents were randomly selected by assigning maximum of twenty (20) and minimum of fifteen (15) respondents to each of the rural communities.

### ***Data Collection***

Data for this study were collected mainly from primary source. Participatory rural appraisal (PRA) technique, namely semi-structured interview (SSI) questionnaire was used in the primary data collection. The use of participatory research technique in collecting e-wallet impact data especially as it concerns rural poor farmers is based on the fact that it involves the people being studied, and their views on all the issues are paramount. The SSI used was divided into three sections. Section one of the instrument elicited information on the socio-economic characteristics of respondent, and the other two sections elicited information based on the two research questions. This semi structure interview questionnaire was the major tool the study used for the household survey. It was directly

administered by the researcher with the help of a few local research assistants. The use of local research assistants was because of the inability of the researcher to speak the different languages and dialects of the sampled rural communities.

### *Analysis Technique*

Data collected from respondents in the field were subjected to series of treatment. Both descriptive and inferential statistics were used to analyze the data, so as to achieve the objectives of the study. In modeling the impact of e-wallet on young rural women farmers, we used the double-hurdle model to achieve our two objectives which are:

- i. To determine the level of participation in the e –wallet programme by the young rural women farmers.
- ii. To ascertain the usage intensity of modern agricultural inputs by young rural women as a result of participation in the federal government e-wallet programme.

Hence the study attempts to answer two basic research questions which are in the areas of the level of participation in the e-wallet by the young rural women farmers and the impact of the e-wallet model on usage intensity of modern agricultural inputs in rural areas in Nigeria. Double-hurdle model is based on the assumption that, participation in the e wallet model and adoption of the ABIs are two distinct or independent decisions (Cragg, 1971). The model assumes that young rural women farmers make two sequential decisions with regard to participating in the government e-wallet model, and adoption and usage of ABIs. The two-stage decision nature implies that participation and adoption of the innovation should be modeled jointly to partly gain estimation efficiency. An advantage of the double-hurdle model compared with the standard univariate Tobit model is that it provides a more flexible framework to model the observed rural young women farmers' behavior as a joint choice of two decisions instead of a single decision.

In this process, two hurdles must be crossed in order to be a user of the ABIs. The first hurdle needs to be crossed in order to be a potential user of the ABIs when a rural young woman decides to participate in the e-wallet model. The second hurdle is that the young rural woman having registered and accepted to participate in the programme becomes a potential user of the ABIs. However other current circumstances of the young rural woman then dictate whether or not she actually adopted, received and used the ABIs. Hence the two equations of the double hurdle model are written as:

$$p_i^* = z_i\alpha + u_i \quad \text{equation} \quad 2$$

$$y_i^* = x_i\beta + v_i \quad \text{equation 3}$$

$$y_i = \begin{cases} x_i\beta + v_i & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases} \quad \text{equation 4}$$

Also

$$t_i = \begin{cases} z_i\alpha + u_i & \text{if } t_i^* > 0 \\ 0 & \text{if } t_i^* \leq 0 \end{cases} \quad \text{equation 5}$$

Hence  $y_i = x_i\beta + v_i$  if  $p_i^* > 0$  and  $t_i^* > 0$  equation 6  
and 0 otherwise

Where  $p_i^*$  is a latent endogenous variable representing the rural young woman's decision to participate in the e-wallet model;  $y_i^*$  is a latent endogenous variable representing the young rural woman's decision to adopt ABIs using the e-wallet model;  $Y_i$  is the observed dependent variable (adoption of ABIs using e-wallet model);  $z_i$  is a set of individual characteristics explaining the decision to participate in the model; while  $x_i$  is variables explaining the decision of the young rural woman to adopt the ABIs using the e-wallet model; then  $u_i$  and  $v_i$  are independent, homoscedastic, normally distributed error terms.

The double hurdle model is estimated using maximum likelihood techniques with the loglikelihood given as follows

$$LL = \sum_{\text{Log}} \left[ 1 - \Phi(Z_i\alpha) \Phi\left(\frac{X_i\beta}{\sigma}\right) \right] + \sum_{\text{Log}} \left[ \Phi(Z_i\alpha) \phi\left(\frac{Y_i - X_i\beta}{\sigma_i}\right) \right] \quad \text{equation 7}$$

To this effect, the empirical model used to estimate the Probit and the truncated model of e-wallet participation, the adoption and usage of ABIs is given below:

$$\text{Pate W or ABIs} = \beta_0 + \text{Age}\beta_1 + \text{HEQ}\beta_3 + \text{MS}\beta_4 + \text{HHsize}\beta_5 + \text{CreA}\beta_6 + \text{Fsize}\beta_7 + \text{OPhone}\beta_8 + \text{SoABIs}\beta_9 + \text{FExp}\beta_{10} + \text{OFI}\beta_{11} + \text{Oput}\beta_{12} + \text{MoNC}\beta_{13} + \text{LOT}\beta_{14} + \text{Ext}\beta_{15} + \text{Dis}\beta_{16} + \varepsilon_i \quad \text{equation 8}$$

Where Pate W is the participation in the e-wallet model among young rural women and which takes the value of 1 for participator and 0 otherwise. ABIs, is adoption and usage of Agribusiness indicators ABI by respondent young rural young women. Other variable used in the estimation are:

$$X_1 \quad \text{Age} = \text{Age of a farmer (years)}$$

- X<sub>3</sub> HEQ = Highest level of educational qualification (years)
- X<sub>4</sub> MS = Marital status of respondent farmer
- X<sub>5</sub> HHsize = Household size of farmer (number)
- X<sub>6</sub> CreA = Access to farm credit by farmers (1=accessed and 0 otherwise)
- X<sub>7</sub> Fsize = Size of farm cultivated by farmers (hectare)
- X<sub>8</sub> OPhone = Ownership of mobile phones (1= owned, 0 = otherwise)
- X<sub>9</sub> SoABIs = Sources of ABIs (1= e-wallet and 0= otherwise)
- X<sub>10</sub> FExp = Farming experience (years)
- X<sub>11</sub> OFI = Off-farm income
- X<sub>12</sub> Oput = Value of farm output in naira (N)
- X<sub>13</sub> MoNC = Mobile network coverage (1= covered and 0 = otherwise)
- X<sub>14</sub> LOT = Land ownership type (1= inheritance, 0 otherwise)
- X<sub>15</sub> Ext = Contact with extension agent (number of times)
- X<sub>16</sub> Dis = Distance to fertilizer selling point (1 = far, 0 = otherwise)
- $\varepsilon_i$  = stochastic error term.

### The Empirical Results

**Table 3.** Maximum Likelihood Estimates of Double Hurdle Models for Participating in E-Wallet Model and Adoption and Usage of CSV by Young Rural Farmers in Nigeria.

Variables	Independent Double Hurdle Models			Marginal effect in probit
	Single Step Probit	1 <sup>st</sup> hurdle	2 <sup>nd</sup> Hurdle	
Constant	-.2531 (.3020)	- 0. 513(0. 32)	-.749 (1.27)***	-
Age (years)	- 154 (.128)**	-0.521(-0.34) **	-168.43 (-0. 216)	-.0010
Education (years)	0.032 (.953) **	0.742(0.416)**	3.152(3.05)***	.04002
Marital status	0.266 (1.139)	-0.148 (0.28)	1.216 (-0.543)**	-.00421
Household Size	- 0.231 (1.21) **	-0. 219 (-3.61)	0. 741(0.42)**	-.02102
Access to Credit	0.6251(0.042) **	-0.0914(0.21)	-2.175(-0.56)**	-.0341
Size of farm	1.302 (0.857)***	.094 (2.76)**	0. 451(0.201)	0.00521
Mobile phone	2. 823(0.034) ***	11.14(-1.25)*	0.325(0.72)*	.3103
Farming experience (years)	3.136 (0.027) *	-.331(-4.73)***	-10.10 (-3.81)**	-.00081
Off Farm Income	0.128 (0.009)**	-0.094(-2.36)**	7.612(1.26)***	-.0042
Value of output (N)	2.91 (0.034)**	6.08(0.32)**	0.925(0.73)**	.00034
Mobile network coverage	3.125 (0.021)**	1.21 (0.032)**	0.321 (3.154)***	.02403
Land Ownership Type	1.08(0.41)*	1.127(2.73)	0.021(1.53)**	.00112
Extension Contact	0.596 (0.018)	1.223(.012)***	5.211(2.412)**	.1007

Distance	-0.021(0.07)***	-0.438(-1.54)*	-11.001(-2.78)**	-0.0561
Number of observations	600	600	600	
Log likelihood	-732.268	-912.718	-956.516	
Prob> chi <sup>2</sup>	0.0813	24.56	17.142	
Akaike Info criterion		216.48	436.362	

Computed from the field data \* = significant at 1% level, \*\* = significant at 5% level, \*\*\* = significant at 10% level

**Source:** Authors' Computation

The maximum likelihood estimates of the double-hurdle model are presented in table 3. The Akaike Information Criteria (AIC) and the Log-Likelihood ratio (LR) attest to the reliability of the model. The AIC is a measure of the goodness of fit of an estimated statistical model and describes the trade-off between bias and variance in model construction. Judging a model by how close its values tend to be to the true values in terms of a certain expected values, AIC values are only for models' ranking as their absolute values have no meaning. In the same vein, the model with the lowest LR is the best. The Coefficients in the first hurdle indicate how a given decision variable affects the likelihood (probability) to Participate in the e-wallet model, while those in the second hurdle indicate how decision variables influence the level of adoption and usage of ABIs. This implies that a young rural woman can fully participate in the e-wallet model but the intensity of her using ABIs can be seriously hindered by the socio-economic factors. From the first hurdle we discovered that age, gender, education, household size, size of farm, farming experience, off-farm income, value of output, ownership of mobile phone, mobile network coverage and contact with extension agents are decision variables that were statistically significant influencing the probability of participation in the e-wallet model. Also the marginal effect of the first hurdle show changes in the probability of participation in the e-wallet model for any additional unit increase made in the decision variables. The result shows that the likelihood to participate in the model drop by 0.1 percent for every unit increase on the age of the farmer. However because the average age of the respondents in this study is 38 years, the probability of participation is high among the respondents. Another socio-economic characteristic of the respondent that is of much importance is education of the respondent, ownership of mobile phone, mobile network coverage and contact with extension agent which every unit increase in them increases the likelihood to participate by 4,31,24, and 10 percent respectively. On the other hand, off-farm income, access to credit, farming experience and distance to registration and or selling point, all reduces the tendency to participate by .4, .3, .8, and 5.6 respectively by any unit increase made in the decision variable.

Also the result of the second hurdle shows that, except age of the respondent and surprisingly size of the farm, all other variable are significant at various level in determining the intensity of adoption and usage of ABIs. Education, ownership of mobile phone, value of output, mobile network coverage, and contact with extension agent are positive determinants of decision to adopt and use the ABIs among the rural young women farmers. Also marital status, farming experience, and distance to the selling point of ABI are negative determinants of decision to adopt and use the ABIs among the rural young women farmers. Two variables that are important that caught the attention of this study are land ownership type which is a determinant factor in both hurdle and, marital status which has no impact in the first hurdle but is significant at 5 percent level in the second hurdle. These two variable has a deep connection with cultural and societal values of the rural people in Nigeria. From table 2, we discovered that about 40 percent of the respondents are either widowed, divorced or separated, the tendency for such people to participate in the e wallet model is high, but lacking access to farm land will hinder their intensity of adoption and usage of ABIs. On the other hand also, the tendency of the of the 51percent who are still married to participate will be low as their farm business are always subjected to that of their husband, however, their access to farm lands appears to be higher. Though participation in the e-wallet model and adopting and usage of ABIs are two separate decisions, the results indicate that e-wallet distribution system enhances the adoption rate of ABI among the rural young women farmers in Nigeria.

### **Main Findings and Discussions**

Summary statistics of our analysis show that the federal government e-wallet programme is making some progress in distributing modern agricultural inputs to small holder farmers in rural Nigeria. This information is supported in Grossman and Tarazi (2014) that compared to the prior subsidy programme, the e-wallet has proven to be more efficient. For example, the federal government spent approximately US\$180 million in 2011 to subsidize modern agricultural inputs, but almost 90 percent never reached the intended participants. The stakeholders estimated that 600,000 – 800,000 smallholders only received subsidized inputs in 2011. By contrast in 2012, the federal government e-wallet reached 1.2 million smallholders with just US\$30 million in subsidy and administrative costs. Even after including the state government matching contribution of US\$23 million, the subsidy cost per farmer dropped by over 80 percent from over US\$230 in 2011. Also, in 2013, the federal government e-wallet reached 4.3 million smallholders at a cost (including subsidies and administrative costs) of approximately US\$96 million.

**Table 4.** Socio – Economic Characteristics of the Respondents

Primary Occupation	Frequency	Percentage	Cumulative
Farming	367	61	61
Trading	131	22	83
Government paid employment	47	8	91
Unemployed/full time Housewife	55	9	100
	600	100	
Years of experience			
0- 5 Years	134	22	22
6 - 10 Years	321	54	76
11 - 15 Years	91	15	91
16 - 20 Years	45	8	99
Above 20 Years	9	2	100
	600	100	
Age of respondents			
Less than 20years	64	11	11
21-30 years	133	22	33
31-40 years	358	60	93
41 years and above	45	8	100
	600	100	
Level of Education			
None	71	12	12
FSLC	150	25	37
WAEC/WASSCE	138	23	60
B.Sc and Equivalent	88	15	75
Post graduate degrees	65	11	85
Others	88	15	100
	600	100	
Marital Status			
Single	54	9	9
Married	308	51	60
Widowed	118	20	80
Divorced	65	11	91
Separated	55	9	100
	600	100	
Household Size			
1-4 Person	442	74	74
5-9 Person	132	22	96
10-14 Person	22	4	99

15 Person -and above	4	1	100
	600	100	
<b>Farm Size</b>			
Less than 1 Hectare	347	58	58
Between 1-2 Hectares	153	26	83
Between 3-4 Hectares	54	9	92
Between 4-5 Hectares	38	6	99
5 and above Hectares	8	1	100
	600	100	
<b>Ownership Mobile phone</b>			
Have a set	290	48	48
Uses a neighbours set	136	23	71
Have no set	174	29	100
	600	100	
<b>Mobile Network coverage</b>			
Network is good	235	39	39
Poor	94	16	55
Very poor	125	21	76
No network at all	146	24	100
	600	100	
<b>Access to electric power source</b>			
Connected to PHCN	135	23	23
Uses Small Generator	130	22	44
Uses Solar energy source	27	5	49
Uses public charger	24	4	53
No access to power at all	284	47	
	600	100	
<b>Monthly Income Level</b>			
0 - 50,000	311	52	52
51,000 - 100,000	165	28	79
101,000 - 150,000	64	11	90
151,000 - 200,000	32	5	95
201,000 - 250,000	15	3	98
251,000 - 300,000	6	1	99
301,000 - 350,000	4	1	100
351,000 - 400,000	2	0	100
Above 400,000	1	0	100
	600	100	

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**Source:** Authors' Computation

Table 4 explains the impact of the socio-economic characteristics of the YRW on the e-wallet programme. For example only 12 percent of the rural young women have no formal education, suggesting that application of the mobile phones to access modern agricultural inputs would not be a

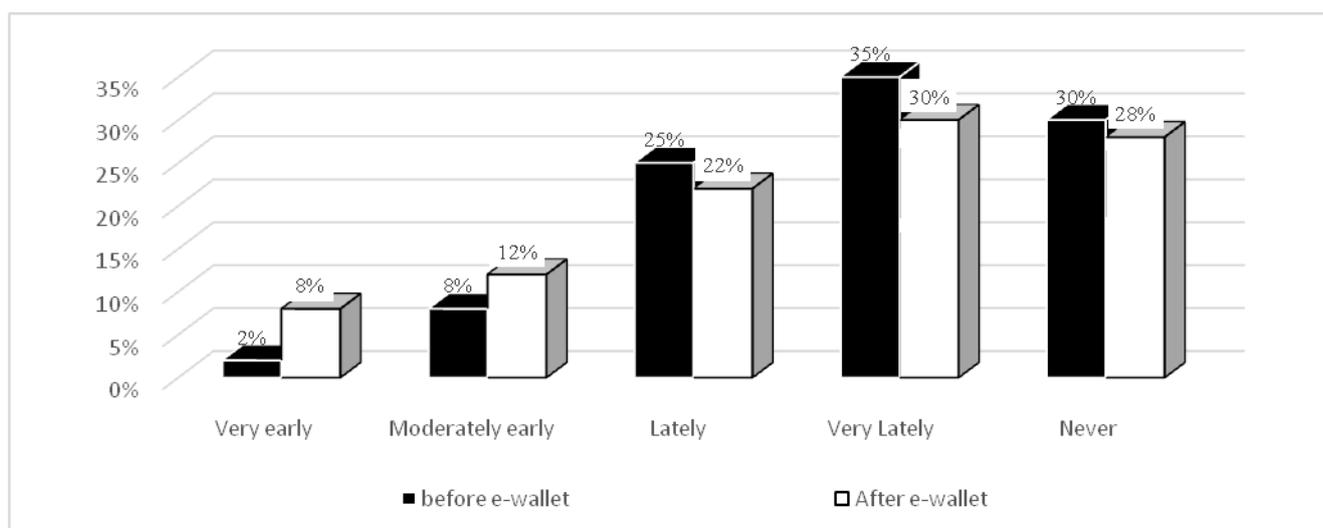
problem as 88 percent of the women can read and write text messages. However, in rural Nigeria, it is common for a young man to woo a wife by buying a good GSM handset for her, even when he does not own a good one.

**Table 5.**Distribution of Respondents by Constraints Faced in Accessing ABI

Actual Cost of ABI	Before e-wallet model			After e-wallet model		
	Freq	%	Cum	Freq	%	Cum
Available and Affordable (low price)	30	5	5	56	9	9
Available and Affordable (moderate price)	55	9	14	96	16	25
Available and Unaffordable (high price)	240	40	54	148	33	58
Unavailable and Unaffordable (high price)	155	26	80	136	23	81
Total lack of information	120	20	100	114	19	100
	600	100		600	100	

Source: Authors' Computation

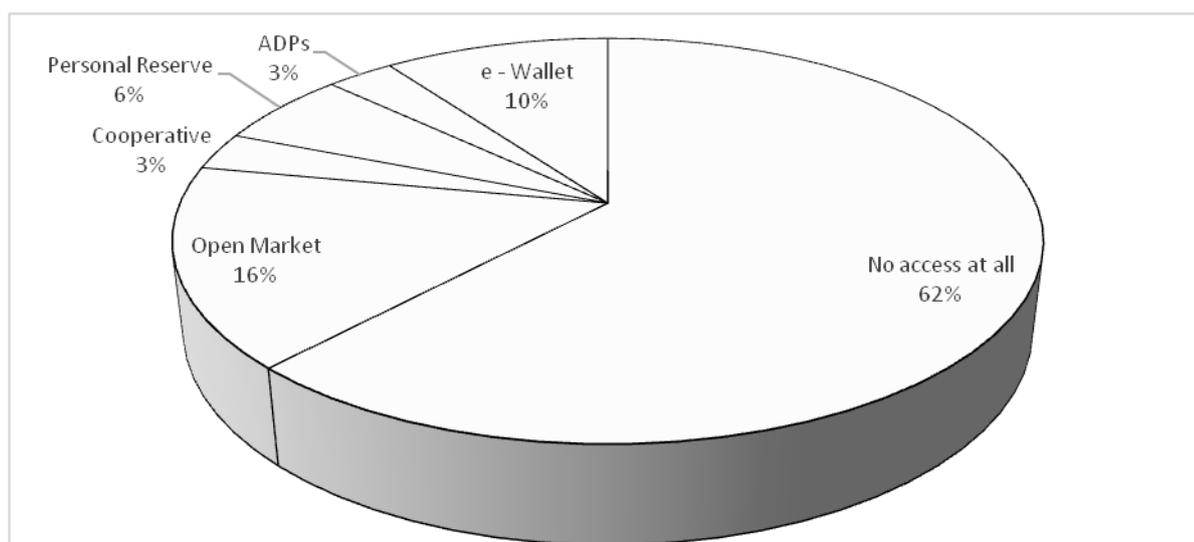
Table 5 indicates that the federal government e-wallet programme increases the availability and affordability of modern agricultural inputs to the YRW, supporting the findings of Olomola (2015) that the e-wallet programme yields many of the federal government desired results.



**Figure 3.**Distribution of Respondents by Timeliness of Getting the ABIs

Source: Authors' Computation

Figure 3 shows that before the federal government e-wallet programme was introduced, only 2 percent of the YRW could access the modern agricultural inputs very early, while 8 percent could moderately early, 25 percent access it lately, 35 percent receive it very late (probably when the farming season is over), and 30 percent never get the input at all. This implies that only 10 percent could be said to access the ABI at the appropriate time it would be useful for them, while 30 percent never access the inputs, and the remaining 60 percent get the inputs when the farming season is over. However, after the introduction of the e-wallet programme and the subsequent participation of some YRW in the programme; the early arrival of the inputs increase to 20 percent; while the late input arrival reduced to 52 percent; those that never access the inputs also reduced to 28 percent. This suggest that if the e-wallet could be gender sensitive designed to deliver for the majority of poor women and girls (Nigeria’s major agricultural producers) who live in rural areas, the programme would have huge potential to reduce gender gap in the country.



**Figure 4.** Distribution of Respondents by Sources of ABIs

**Source:** Authors’ Computation

Figure 4 shows that only 10 percent of the YRW access ABI through the e-wallet programme, while the rest access the ABI from other sources. This indicates that the 20 percent that access ABI early is accounted for by this 10 percent who are e-wallet participants. This suggest that a 1 percent increase in the number of YRW participant in the e-wallet programme doubles the rate of early access to ABI, all things being equal. Meanwhile, the context of the YRW shows that they are majorly tenant farmers who do not typically own land, but have access to it through their husbands or adult sons, as

customary rules demand. Also, except for a few crop, most varieties being planted now in rural Nigeria by the YRW are improved seeds, and fertilizer application rate have improved to 13 kilograms per hectare annually.

In rural Nigeria especially, the gender gap is even wider and the situation is more complex due to the cultural and traditional context which is anchored in beliefs, norms and practices which breed discrimination and feminized poverty. This supports the growing evidence in AFDB (2015) that the number of women in Africa living in poverty has increased disproportionately to that of men; women's participation in the market economy has increased, especially in the informal sector, however at the same time women's domestic workloads have not declined. YRW in Nigeria have continued to be primarily responsible for such activities as the care of children and the elderly members of the household, cooking and cleaning, fetching water and firewood, and managing the household's livestock. This is especial true for young rural poor women in Nigeria who do not have the resources to hire additional labour to take over some of the household responsibilities when they engage in market activities in traditional village squares. Also, the current barriers to YRW access to and control of land need to be addressed through policies which take women's right and needs into account.

Over all, the majority of Nigeria's YRW is poor and depends on tenant farming as their source of livelihood. While productivity of YRW is undermined by access to modern agricultural inputs has left the country with less than desired levels of productivity in the agricultural transformation agenda. Gender disparities in agriculture in the rural areas are mainly characterized by unequal access to modern agricultural inputs. Pervasive inequality, especially over the ownership of agricultural land, continues to limit YRW's contribution to household food baskets, and most YRW do not have access to agricultural inputs, apart from their own labour. However, our result indicates that YRW will depend on the federal government e-wallet programme for increased usage intensity of modern agricultural inputs in Nigeria. Our findings agree with Labonne and Chase (2009) on power of information and the impact of mobile phones on farmers' welfare. Also, our findings concur with Mittal and Mehar (2012) on effective contribution of mobile phones to the growth of small farmers. More closely related, our findings support Mittal (2015) that mobile phone-enabled information delivery mechanism has the potential to reduce the knowledge gap between large and small farmers, and also across gender by creating awareness and knowledge. Similar, our finding is cohering with Mittal (2016) on the role of mobile phone-enabled climate information services in

gender-inclusive agriculture, which suggests that information delivered through mobile phones helps to reduce the information gap between farmers and has the potential to enhance productivity. However, in extension and contribution, this paper demonstrates a pro-gender approach from the African gender perspectives that Nigeria's agricultural transformation agenda can only succeed if the FGN is able to draw on all its resources and talents, and if YRW are able to participate fully in the e-wallet programme. This will require intensified efforts to eliminate discrimination and promote equalities in accessing modern agricultural inputs.

## **Conclusion and Policy Implications**

Thus far, we assess the extent young rural women participate in the federal government e-wallet programme and the subsequent impact on usage intensity of modern agricultural inputs in Nigeria. The paper contributes to the gender debate in agriculture from the e-wallet perspective by assessing the empirical evidence in two areas that has received much attention in the literature:

- i. What is the level of young rural women's participation in the e-wallet programme in Nigeria?
- ii. Does e-wallet programme impact on young rural women's usage intensity of modern agricultural inputs in Nigeria?

Six hundred YRW were sampled across six geopolitical zones of Nigeria. Using double-hurdle, results show that YRW rarely participate in the e-wallet programme due to the cultural and traditional context which is anchored in beliefs, norms and practices that breed discrimination and feminized poverty. This implies that Nigeria's agricultural transformation agenda would only succeed if the FGN is able to draw on all its resources and talents, and if the YRW can be able to participate fully in the e-wallet programme. This will require intensified efforts to eliminate discrimination and promote equalities. To bridge the gender gap, the federal ministry of agriculture and rural development should pay close attention to the extent the participation of unmarried girls and young women, including nursing mothers in the e-wallet programme, may be limited by the cultural and/or domestic and child care duties. The findings suggest that FGN should discourage gender disparities in unequal access to agricultural inputs and pervasive, inequality, especially over ownership of agricultural land that limit women's contribution to household food baskets.

However, as debate on gender in agriculture continues, it will be insightful to extend this study with what YRW do in agriculture and rural employment in developing countries. Such study should also

look at the demographic trends in rural areas with regard to gender composition of rural population for development.

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