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# EFFECT OF ACCESS TO INNOVATIONS ON ASSETS ACQUISITION AND DEVELOPMENT CAPACITY OF WOMEN IN RURAL NIGERIA

Nurudeen Afolabi Sofoluwe<sup>1</sup>

## Abstract

This study investigates the attribution effect of access to innovation on assets acquisition and development among rural women. The study analyzed gender differences in access to innovations and its consequence on assets ownership among rural males and females. Primary data for the study were sourced through a structured questionnaire. The data was fitted to a propensity score matching model in order to isolate the effect of access to innovation on gender differences in an asset acquisition. The findings showed that rural development drive requires innovative intervention in the rural areas and its effect could be more favorable to males than females in terms of productive asset acquisition and development. But, no significant difference (5% level) was established for non-productive asset acquisition across gender. There is a need for gender-inclusive strategies for rural development.

**Key words:** gender, innovation, assets, rural development, propensity score matching.

**JEL<sup>2</sup>:** J16, R51

## Introduction

In most African nations and developing countries in general, the adoption of improved technologies in agricultural is essential for the growth of most rural communities. Such adoption is considered to be an important pathway to increasing income, and building livelihood assets across gender lines (Fisher, Kandiwa, 2014; Oladokun et al., 2018). However, adoption rates among a group of male and female farmers in rural areas are not proportional. Considering the agrarian nature of most rural areas, agricultural-based innovation is of great importance to rural development. But, the existence of gender imbalance in the acquisition of livelihood enhancing innovations confounds the relevance of continuous introduction of agricultural technology (Odurukwe, 2003; WDR, 2012). As a possible pathway out of rural livelihood constraints, Sunding and Zilberman (2001) suggests increased efforts in

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rural development drive through improvement in the rural household capacity of poor women and men. Among several narratives, the agrarian nature of the rural societies needs to be put into perspective in the discourse of rural developmental agenda. Thus, scaling up innovations that focus on major rural activities becomes imperative.

Considerably, development emanating from innovation in smallholder agriculture, which is central to rural livelihoods, could impact directly on reduction of rural poverty, and indirectly on the overall growth of the wider rural economic system. Nonetheless, the wide marginalization in the rural environment concerning gender distribution in access to productive assets could constrain further development. Hence, broad rural development goal requires distributed access to opportunities and innovations, relevant information and livelihood enhancing assets by women and men rural dwellers, to boost productive activities in the rural communities.

The developmental objective of raising assets in rural set-up necessitates among others, broad investments in technological innovation including seed varieties for an improved agricultural outcome, and extensive usage of such innovations by both women and men in rural agrarian activities (Sofoluwe, 2015). The findings that local-based gender relations are required in the understanding of the relationship between technological uptake and asset ownership (Padmaja et al., 2006), support the need to expand the use of asset-enhancing innovations across gender. Deji (2011) define gender from the perspective of socially constructed role of male and female. Identifying the gender differences in the use of innovations is crucial. If gender affects the process of using innovations directly or men and women farmers have varying characteristics that affect asset response to new innovative ideas under the same constraints, it could be essential to adjust research approaches to ensure that innovations are developed to match male and female dissimilar needs. Explicitly, this study analyzed the effect of agricultural innovation on assets acquisition of female farmers with reference to male farmers in rural Nigeria. To isolate the specific effect of the innovation on differential assets acquisition across gender, this study adopts control based analytical approach. Thus, findings from this study will help various stakeholders involved in the rural sector's development towards the formulation of appropriate gender-responsive innovation policy to enhance assets acquisition of the rural populace.

### **Literature Review**

Development and accumulation of assets, most especially in the rural settings would require suitable investments and the resulting earnings in addition to broad access to land inheritances and transfers (Gale, Scholz, 1994). But, the broad effect of such

opportunities on development outcomes would depend on increasing gender equity over assets (Sofoluwe, 2015). Due to its importance as a stock variable rather than a flow, assets distribution for women and men in the rural areas (Kasente et al., 2000) would put a check to increasing “feminization of poverty” in rural societies.

An important insight into the developmental agenda in the rural areas is to promote innovations peculiar to the rural set-up to enhance gender distributed access to productive assets including land and farm machines (Padmaja et al., 2006; Horrell, Krishnan, 2007). The expected result is a translation into broad asset development and long term impact on sustainability drive (Deere et al., 2010). Across different types of assets, differentials in asset ownership and opportunity to develop such is limited even in the presence of innovation. Gilbert (2010) reported variation in access to non-productive assets in South Asia. But, the magnitude of such variation was not captioned. Peterman et al. (2010) also reported lower access of women to technological innovation and essential assets than men in the rural settings. Expectedly, an increase in access to innovation by women on a balance scale could enhance the productivity of rural agrarian communities. It could also contribute to an increase in the number of assets acquired by women (WB, 2007). Thus, avoiding gender asset gaps could reverse loss in rural development drive and investments. Quisumbing and McClafferty (2006) estimated that minimizing inequalities in human, physical and related assets across gender in the sub-Saharan Africa is capable of increasing rural agricultural productivity by a margin of not less than 10%.

Despite the reported gap in gender wealth distribution, Ruel and Hauser (2012) opined that the gender classification problem is the primary cause of the gender asset gap. In essence, the reported difference between males and females concerning access to innovation and gender is not a problem in itself but the marital factor that confounds gender classification. The import of the submission by Ruel and Hauser (2012) is that if assets are owned in the same house, and in different proportion, marital factors should be implicated and not the difference access to technological innovation. In the analysis of factors driving innovations acceptance among male and female-headed households, Duvel et al. (2003) pinpoint the role of gender difference in household behavior.

The consequence of gender was found to be largely and significantly manifested in education, and credit access among other factors. Similarly, Weir and Knight (2004) highlighted education as a significant factor in the acceptance of technological innovations in rural communities. In another study on innovation, farmers’ gender and availability of seed technology being the innovation were found to affect reactions of rural farmers (Masangano, Miles, 2004). Despite numerous pieces of literature on gender and technological innovations, most existing studies on

innovations have focused more on methodological concepts and the factors affecting the adoption of such innovations.

In the analysis of gender issues in South Asia, World Bank (WB, 2009) observed complexity in the land tenure systems at both customary and statutory levels which defined gender variation in assets. The constraint of rights enforcement to asset ownership through legal process was also observed, most especially for women. Gilbert et al. (2002) also recorded differences in gender access to education, and agricultural extension service in developing nations of Africa and South Asia (WB, IFPRI, 2010). It is however imperative to note that in most Africa countries, women do have other peculiar opportunities that positioned them for appreciable strength in assets ownership (Sofoluwe, 2015). Due to the relevance of innovation in overall or inclusive development especially in the rural settings, Cozzens and Sulz (2014) focused their research attention on innovation in the informal set-up and including 'gender' as the driving factor. Though the study is non-empirical, the authors considered the outcome of innovations to the disparity in women and men involved in the development agenda. Whereas, the expected flow of assessment is to determine the effect of innovation in rural activities across gender on development-assets accumulation. Research of Katungi et al. (2008) was more of reverse estimation which focused on how the acquisition of asset-social capital could influence gender involvement in an innovative intervention for rural dwellers.

### **Methodology**

The research was conducted in rural areas of the Southwestern region of Nigeria. The study area lies between latitude 4° N and 9° N and longitude 3° E and 6.2° E. The total population of the zone as at 2006 stood at 27,722,432 composed of 14,081,157 male and 13,641,275 female. The choice of the period (2006) is premised on the absence of a fresher National census since 2006. Most existing data on Nigeria population after the period are mere projections with different incoherent values whose usage could result in fabrication of a sensitive data such as population census. The climate in the study area is tropical and characterized by wet and dry seasons. The temperature range of the area is between 21° C and 34° C while the annual rainfall is between 1,500 mm and 3,000 mm. The vegetation in the area is made up of freshwater swamp and mangrove forest at the belt. Food crops such as maize, cassava, yams, cocoyam, and vegetables are grown in the area. The sample was chosen using a multistage sampling process. Out of the six states that make up the sampled zone, three (Oyo, Ogun, and Osun) were purposefully chosen because they are part of those exposed to adoption of agricultural innovation and improved production capacity. Following the sampling of the states, a random selection of the villages (8) in each of the selected areas was conducted. Based on access to the innovation, the selected rural

residents who are into maize production were divided into gender groups. Given the total population of the study, sample size was selected by considering a confidence level of 95% at 5% margin of error. This gives an expected sample size of 385 total respondents. However, forty of the responses were found to be inconsistent and were therefore discarded in the subsequent analysis. This leaves a total sample size of 345.

Following the gender classification of the respondents, proportional sampling of one hundred and ninety seven male maize producers and one hundred and forty-eight female maize producers were randomly sampled. Thus, a total of three hundred and forty-five maize farmers were surveyed. The information gathered was primary. The information was gathered through a structured questionnaire and gender based data. In the three states chosen, the data was collected by the researcher with the help of some professional enumerators. The data was taken throughout the summer of 2018 during the months of June and August. To estimate gender differentials in assets acquisition due to the innovations, the propensity score matching method was used following similar studies such as Koru and Holden (2011). The analysis procedure was implemented using STATA13.0. For this study, the most important parameter in the PSM framework is the estimate of assets differentials among male and female farmers using the innovation and this is expressed as:

$$\tau_{ATT} = E(Y_1 - Y_0 / D = 1) = E(Y_1 | D = 1) - E(Y_0 / D = 1) \quad (1), \text{ where:}$$

$Y_1$  denotes the value of the assets of males with access to innovation (1), and

$Y_0$  is the value of the asset variable for the females (0).

Assets acquired which are the outcome variables to be estimated were divided into productive and non-productive assets. Both asset classifications were measured by their values in Naira currency (365.01 NGN = 1 USD). The productive assets measured included land, implements, and means of transportation while non-productive assets are the individual (non-farm) assets of male and female rural participants.

## Results and Discussion

Gender differentials in asset acquisition in response to innovations in the rural setting were estimated through three different matching algorithms. These are Nearest neighbor, kernel and stratified matching. As expected, the three algorithms yielded asymptotically similar results. To control for gender factors that could influence differences in an asset acquired, imposition and the setting of balancing property were constructed based on individual, farm-firm and institutional characteristics that define gender. The result of the balancing test (Table 1.) was satisfactory at a 5% level of significance.

**Table 1.** Balancing Test of Covariates

Element	Mean			t-test	
Variable	Male	Female	%bias	t	P-value
Age	51.87	51.69	1.9	0.23	0.82
Marital	1.99	1.97	3.9	0.78	0.43
Years of education	7.94	6.72	22.3	2.46**	0.01
Years of experience	19.93	19.59	3.4	0.42	0.68
Farm size	4.19	4.45	-12.7	-1.51	0.13
Membership of association	0.38	0.28	20.4	2.37**	0.02
Access to seed	0.90	0.91	-1.1	-0.15	0.88
Access to credit	0.51	0.04	16.6	1.88*	0.06
Land acquisition	0.63	0.007	-25.1	-3.00***	0.00
Pseudo R <sup>2</sup>	0.047				
LR Chi <sup>2</sup>	33.00				
P > chi <sup>2</sup>	0.000				
Mean bias	11.9				
Std. Dev.	9.55				
Median bias	12.7				
Variance	91.23				
Skewness	0.010				
Kurtosis	1.358				

Source: Data analysis based on RuDep, 2018.

Note: \*\*\*, \*\* indicate significance at 1% and 5% respectively.

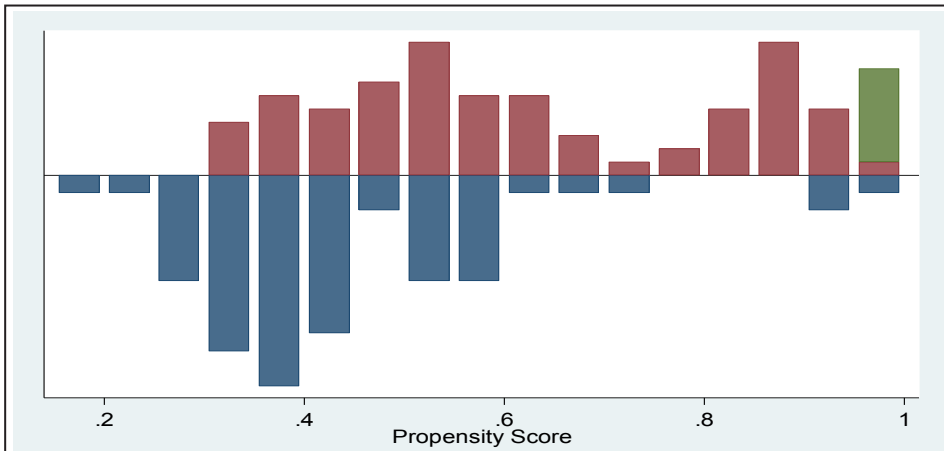
Our findings suggest that variation and or differentials in the value of assets acquired are occasioned by rural-based innovation. It is very suggestive that socio-cultural factors such as differences in age, years of experience, size of the farm and access to innovation play a significant role in the assets divide among the rural populace. The results indicate that males are able to acquire productive assets more than females. This suggests gender differences in asset acquisition among males and females in rural areas. Furthermore, the opportunity provided by agricultural innovations towards increasing the level of assets, is also bias against rural women.

The percentage bias due to gender differences in years of education and access to credit are 22.3% and 16.6% at 5% and 10% levels of significance respectively. The per cent bias due to gender differences in land acquisition is 25.1%. The analysis of Covariates presented in Table 1. show that male and female respondents have dissimilar characteristics. Graphical representation of the oscillation in gender variation is illustrated in Figures 1. and 2. The results presented in the Figures 1. indicate an existence of bias in the distribution of assets between males and females' respondents. This bias could be attributed to socio-cultural factors of asset ownership in most rural communities in Nigeria. The variations among



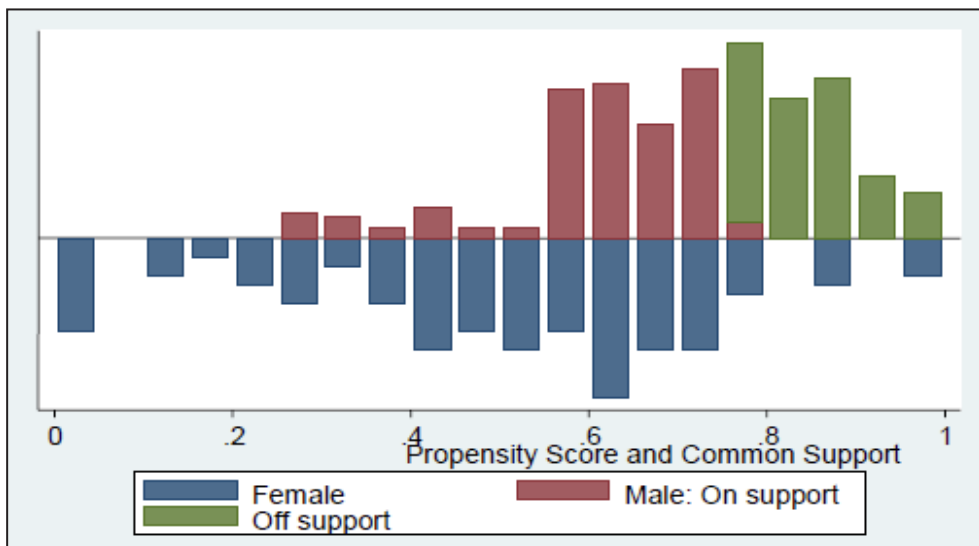
gender are shown to be higher with respect to access to education, credit, land and membership of association as represented in the 'off support' illustration in Figure 2. The 'support' in the model refers to the area where there is overlap between the subjects of study. When there is 'off support' there is no positive balance between the characteristics of male and female which results in the observed variations in assets acquisition.

**Figure 1.** Graph of Propensity Score



Source: Data analysis based on RuDep, 2018.

**Figure 2.** The graph of propensity score distribution and common support



Source: Data analysis based on RuDep, 2018.



The results presented in Table 2. show that introduction and access to innovation in rural areas does not guarantee evenly-distributed assets among males and females in the rural areas.

**Table 2.** Estimated Gender Differentials in Asset Acquisition

Element	Nearest Neighbor	Kernel matching	Stratified matching
<b>Productive Asset (NGN)</b>			
Male	238,038.33	236,970.64	236,970.64
Female	177,048.551	203,006.6	177,048.55
Difference	60,989.78	33,964.04	59,922.08
Bootstrapped std. error	15,307.87	20,696.25	15,335.11
t-statistics	3.98***	3.91***	3.91**
<b>Non-productive Asset (NGN)</b>			
Male	86,018.02	87,184.4335	88,955.65
Female	157,335.317	138,678.36	136,242.29
Difference	-71,317.3016	51,493.92	-47,286.64
Bootstrapped std. Error	48,799.54	30,035.38	30,651.849
t-statistics	-1.46	-1.61	-1.54

Source: Data analysis based on RuDep, 2018.

Note: \*\*, \*\*\*, \* significant at 5%, 1% and 10% respectively.

Results show that the value of productive assets owned by male rural dwellers, due to access to innovation, amount to 238, 038.33 NGN (652.14 USD) while that of the female was 177 048.55 NGN (USD 485.05). The estimated difference in the value of productive assets acquired by males and females was 60, 989.78 NGN (167.09 USD) in favor of males. The difference was found to be significant at a 5% level. This result supports some empirical literature asserting the gap in wealth accumulation between males and females especially in the rural areas. On the contrary, the value of the non-productive asset which is mainly composed of individually owned assets was higher for females than males in the rural areas. Concerning non-productive assets acquisition which is mainly composed of individually owned assets by males and females due to innovation, no significant difference (5%) was found.

## Conclusion

Agenda for rural development must necessarily include assets build-up across gender. The extent to which this could be achieved may depend on access to innovations in the rural environment. We focused on the analysis of assets distribution productive and non-productive, among rural maize farmers using gender approach. Specifically, we analyzed the effect of access to innovations in rural areas on the acquisition of assets among females with reference to males. There is evidence of significant

variation in assets acquired by males and females in the rural settings occasioned by access to innovations in productive engagement. We posit that efforts directed at raising development targets for rural areas should not be unidirectional. While the introduction of innovation could generate opportunities for males and females, it could lead to assets distribution bias possibly due to the cultural structure of rural settings. It does not, however, foreclose equity for women in terms of assets as espoused by several studies it only implies designing appropriate technology and dissemination of suitable innovations that befits the organizational structure of specific or largely homogenous rural communities. Despite the findings of the study, there are limitations which may serve as gap for future studies. First, the study focused on maize farmers in the rural areas. This focus limits other possible findings on producers of other crops in the rural areas. Future studies may be more expansive by extending the coverage to other rural farmers involved in different crops. Second, the study is based on disaggregated data on gender. A full perspective of asset ownership due to innovations in rural areas may be explored holistically. Further, the finding of the study necessitates a need for further study on the role of cultural diversity on access to assets among rural developing nations.

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