



Gendered Analysis of Households' Uptake of Agricultural Technology, Production, and Food Consumption in Rural Nigeria

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Abstract

The literature suggests marked gender inequality in the use of agricultural technology despite the availability of evidence that women could be as productive as men when given equal access to agricultural resources. This underscores an urgent need to consider improving women's access to agricultural technology to ensure sustainable provision of food for all people and particularly those in developing countries. This study addresses two specific objectives: (a) it examines gender differences in households' use of farm-level technology (herbicide, pesticide, and inorganic fertilizer) and (b) it

assesses the impact of the uptake of agricultural technology on farm production and food consumption with particular attention to the gender of the household head. The results of the Three Stage Least Squares (3SLS) regression reveal that households' uptake of agricultural technology has a significant positive effect on their dietary diversity and food consumption expenditure per capita due to increased farm production. While these results are consistent regardless of the gender of the household head, the extent of effects for female-headed households are almost twice those for male-headed households. Therefore, an essential policy implication of our result is that the government could use input subsidies to address some of the gender gaps with regard to agricultural technology access and use. Such efforts address any entrenched inequalities in women's access to agricultural production resources and consider other socioeconomic factors such as education and landholding which contribute to gender inequality in agricultural technology uptake.

Introduction

Many developing countries face the challenge of addressing combined effects of population growth and climate change on the sustainable provision of food for all people (Hall *et al.*, 2017). Low-income countries, including those in sub-Saharan Africa (SSA) face stagnant agricultural productivity and persistent food insecurity (Takahashi *et al.*, 2020). The uptake of agricultural technology, such as, herbicides, pesticides and inorganic fertilizers by smallholder farmers who contribute a significant proportion of food in these low-income countries has been the most recommended policy option to address the challenges (Duflo *et al.*, 2007; Schneider & Gugerty, 2011; Liverpool-Tasie, 2015). However, evidence suggests significant gender inequalities in adopting these technologies due to barriers such as sociocultural norms and beliefs about gender roles, inadequate policies deliberately targeted at gender equality and lack of agency and resources for effective policy implementation (Rola-Rubzen *et al.*, 2020).

It is estimated that approximately 80 percent of agricultural production in most African countries comes from smallholder farmers who are primarily rural women, but they are less likely to access and utilise improved agricultural technologies than their male counterparts (Doss & Morris, 2001; Mugege, 2013; Odiwuor, 2022). For instance, in the ECOWAS sub-region, the application of appropriate fertilizers remains low, with an average annual application rate of 12 kilograms per hectare. This falls short of the 50 kilograms per hectare target by 2015 set by African governments (Falaju, 2016; IFDC, 2016). Such a low uptake rate of agricultural technology can be potentially traced to poor finance, lack of access, and lack of knowledge of farmers regarding these technologies (Ellis *et al.*, 2007).

There is, therefore, rising momentum in policies targeted at improving the rate of agricultural technology uptake by farmers, especially women in rural Africa. In the ECOWAS sub-region, for instance, there are structures set up to improve agrarian technology uptake, such as the West Africa Fertilizer Program (WAFP) which is focused on improving agricultural production through the distribution of high-quality and affordable fertilizers, to the most constrained farmers (IPES-Food, 2020). In recent years, Nigeria has implemented a farming promotion policy that targets agricultural sector sustainability and rural development by 2020 (FMARD, 2016). This ambitious policy is also targeted at enhancing agricultural technology uptake among farmers in general and women in particular. Efforts are also taken to develop an input market (Druilhe and Barreiro-Hurlé, 2012; FMARD, 2016), which is an essential component of the structural progress of the agricultural sector.

Available statistics on the agriculture sector's contribution to GDP for the three quarters of 2016 and 2019 suggest that some progress has been made, albeit the inherent challenges of the policy. While the agricultural sector grew by 8 percent, crop production, livestock, forestry, and fishing grew by 8 percent, 2 percent, 10 percent, and 6 percent, respectively. Despite the efforts made towards developing an input market and improving aggregate production, the gender dynamics of the extent to which the uptake of these technologies has impacted household food production and consumption is still unknown. There is limited literature on how such policies targeted at bridging the gender disparity in adopting agricultural technologies impact farm production and consumption in male-headed and female-headed households in rural Nigeria, where agriculture remains the main source of economic activity and livelihood.

This paper, therefore, sets out to analyze the effects of technology uptake on farm production and food consumption of households in rural Nigeria. The specific objectives, therefore, are to (a) determine the gender differences in households' use of farm-level technology (herbicide, pesticide, and inorganic fertilizer) and (b) examine the impact of the uptake of agricultural technology on farm production and food consumption with particular attention to the gender of the household head. This study provides a gender-focused assessment of the household farm production and food consumption impact of agricultural technology uptake policies, which are targeted at closing the inequality and poverty gap for rural transformation and sustainability in Nigeria.

Earlier studies concluded that women bear a large proportion of the burden from household food consumption although they earn less than men (UNCTAD, 2011; Amu, 2005; Orkoh, 2018). Consequently, understanding some policies to improve household food capacity, especially for female-headed households, is in tandem with the United Nations Sustainable Development Goals (SDGs) 2 and 5, which respectively seek to achieve zero hunger and gender equality and empowerment of women and girls by

2030 (United Nations, 2020). In addition, the statistics on the nutritional outcomes in Nigeria are staggering. Nigeria ranks 96/113, disaggregated as 101, 100, and 77 for affordability, availability, quality, and safety respectively in the Global Food Security Index – GFSI (GFSI, 2018). Therefore, there is a need for a comprehensive assessment of the extent of uptake and the effectiveness of the agricultural policies targeted at addressing this situation (World Bank, 2018).

Agricultural activities in Nigeria and the role of Women

The agricultural sector contributes significantly to the economy of most African countries. In Nigeria, for example, the agricultural sector contributed about 24.14 percent to the country's Gross Domestic Product (GDP) in 2020 and about 34.97 percent to the total employment as at 2019 (World Bank, 2021). Women constitute nearly half of this agricultural sector workforce and are mainly engaged in smallholder activities or subsistence agriculture. In addition to being responsible for taking care of small ruminants and poultry, women are more likely to be responsible for marketing agricultural products and livestock by-products. Those engaged in crop planting mostly grow yams, cassava, and maize, while men tend to manage plots that grow sorghum, maize, and beans (Oseni *et al.*, 2013). More importantly, the extent of the coping mechanisms of these rural smallholders, when confronted with adverse environmental and farm conditions like pest and weed infestation, complicates farm processes for rural women considering the high poverty rate and low use of modern agricultural technology, which definitely affects production from year to year (The World Bank, 2014).

This challenge is however severe for women whose active participation in agricultural activities is affected due to a number of obstacles. Key among these obstacles is excessive workload and social constraints that result in gender-based discrimination, and poor access to agricultural input compared to their male counterparts. In Nigeria, for instance, male plot managers are more likely than female plot managers to use fertilizer inputs (42 percent and 19 percent, respectively) and herbicide (26 percent and 6 percent). The combined effects of gender-based social constraint make women more prone to poor nutrition, poor health, and poor well-being in Nigeria (Oseni *et al.*, 2013).

As part of the effort to address the aforementioned challenges, the Nigerian government together with foreign donors such as the United Nations Development Programme (UNDP) has rolled out some agricultural interventions to improve the agricultural output in rural areas through projects and programs that are gender sensitive. Among the numerous initiatives are the Agriculture Development Program, Agricultural Credit Guarantee Scheme, Rural Electrification Scheme, National Agricultural Land Development Authority, Strategic Grains Reserves Programs, Agricultural Transformation Agenda with use of e-wallet, Anchor Borrowers

Programme, Agricultural Promotion Policy, and Rural Banking Program, which are directed at improving the agricultural sector in Nigeria (World Bank, 2014). Of all these initiatives, the FADAMA project stands out as a typical example that creates opportunities for women through domestic, social, and productive investments.

The implications of these interventions for the household's well-being will be more effective if they are equally gender-inclusive through targeted programmes to improve the agricultural productivity of women. Women, especially in rural Nigeria, participate actively in agricultural activities through smallholding activities, contract farming, and the out-grower schemes. Despite their participation, they earn less than their male counterparts in most aspects (Olayinka, 2013) and are actively engaged in the non-paid labour allocation within the household, which includes home keeping, childcare, and food preparation. Focusing on food preparation, women in rural Nigeria, just like some other African countries such as Cape Verde (see UNCTAD, 2011), are more engaged in activities that ensure sufficient food consumption within the households. Hence, these input-related interventions by the government, if it is highly sensitive to inclusive participation – especially in considering females, will have significant implications on household poverty, food nutrition, and even production.

Conceptual framework

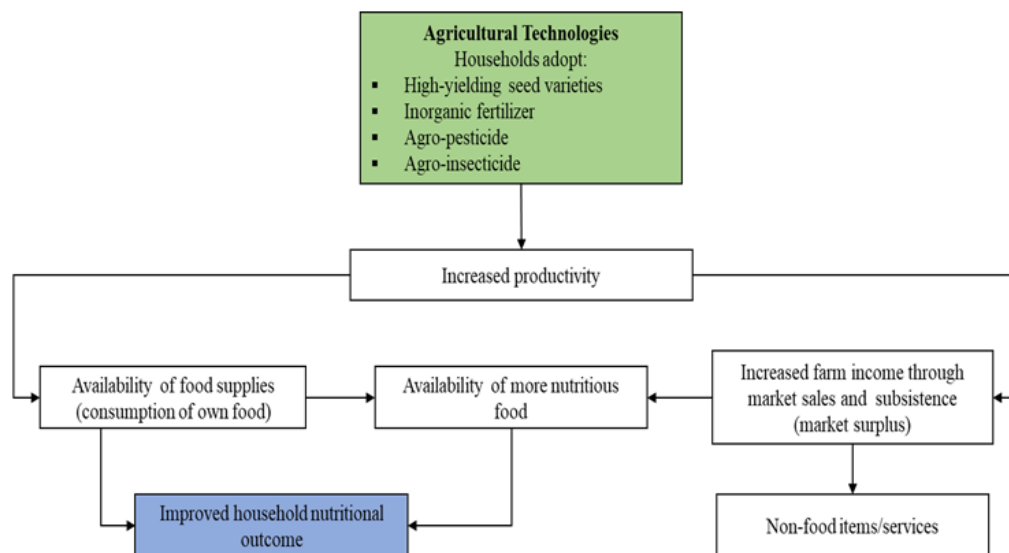
The framework that conceptualizes the connection between the uptake of agricultural technology, household production, and food consumption (nutritional outcomes) is displayed in Figure 1. Thus, the agricultural technology that is of interest to this study includes the components of Green Revolution Initiatives, such as high-yielding seed varieties, synthetic fertilizers, and pesticides/herbicides. Therefore, encouraging households to adopt this technology is worthwhile considering, noting that this group-females constitute the largest labor input in the agricultural sector in rural Nigeria. The uptake of these technology inputs will enhance farm production and reduce farm losses from pests and herbs. The improved production is expected to enhance households' nutritional outcomes via two channels: 1) increased availability of food supplies and consumption of own produce: 2) and increased farm incomes due to market surplus, which would make it possible for households to buy more nutritious food.

First, depending on the extent to which households consume what they produce, improved production due to households' uptake of agricultural technology would contribute to an increase in the availability of food supplies. A household that consumes a higher proportion of its produce will in turn improve the health status of its members and result in a healthy household workforce for higher agricultural production. Asiedu *et al.* (2015) have elaborated on this proposition and its implication for the quality of the health of household members.

The second channel of the effect of agricultural technology uptake is dependent on the extent to which households sell their produce and their decision about the use of the additional income from market surplus for increased food production. A household that is able to produce in excess of its consumption due to its uptake of agricultural technology may decide to spend the additional income earned from the sales of the increased food production on non-food items or services. In that case, the increased production may not directly contribute to household nutritional outcomes. It may, however, contribute to other welfare indicators including health and good living, which may contribute to agricultural production and its associated nutritional and non-nutritional outcomes. While production is the main indirect channel of the effect of agriculture technologies uptake, we also explore their potential direct effect on nutritional outcomes. As indicated in equation one of the estimation techniques, these direct and indirect effects of agriculture technologies uptake on nutritional outcome are accounted for in the empirical modelling. The non-food expenses based on income from increased production are captured in the household and individual-level control variables included in the analysis.

In the Nigerian context, women in rural households participate in unpaid care and family work, home improvements, and even food consumption within the household (see Uwakwe, 2004; Fapohunda, 2012). This implies that the income they derive from these improved agricultural productions as a result of adopting the agricultural technology will logically be used to increase household food consumption outcome.

Figure 1: Conceptual Framework



Source: Authors' construct

Data source

The data for this study are sourced from the World Bank's Living Standards Measurement Study (LSMS) - Integrated Household Survey for Nigeria. The LSMS data is a nationally representative survey that contains about 5,000 households from different states of Nigeria for two seasons – post-planting and post-harvest. We rely on the latest wave of the survey to reduce measurement errors that could arise from changes in the gender of the household head status that are evident across different waves of the data. We specifically rely on the 2018/2019 survey period of the LSMS data for this study. This survey contains information relating to agricultural performance, welfare measures, improved agricultural technologies usage/uptake and other household characteristics that are useful for our estimations. The survey also covers different crop categories that are grown by the households and detailed information about the farmlands of the household.

It is important to note that in the context of this study, we focused on households that are located in rural areas where the main activity of the adults in the household is in the agricultural sector. The analysis of this study is at the household level. An earlier study suggests that in Nigeria, the extent of gender involvement in agricultural production and their contribution to the household food basket vary from one ethnic group to another. A review of the literature reveals that women in Anambra State of Nigeria contribute more than men in terms of labour input in farming and are solely responsible for household management duties. Similarly, between 70 and 80 percent of the Jukun, nomadic Fulfude and Kulka farmers were found to be women (Mohammed & Abdulquadri, 2012). These differences may reflect differences in household decisions regarding agriculture technologies uptake.

Conclusion and policy implications

There is evidence of entrenched gender inequality in access to and adoption of agricultural technologies in developing countries. However, empirical analysis of the implications of this inequality for household food consumption and dietary quality remains limited. The present study fills this gap in the literature by assessing the food consumption effect of increased agricultural production due to household's uptake of agricultural technology (namely herbicide, pesticide, and inorganic fertilizer) in rural Nigeria with particular attention to gender. Specifically, the study examines the effects of production as a medium through which agricultural technology uptake affects food consumption of male-headed and female-headed households in rural Nigeria.

The data used for the purpose of the study were extracted from the World Bank's Living Standards Measurement Study (LSMS) – Integrated Household Survey for Nigeria. We measured food consumption using two indicators: the total value of household food expenditure per capita, and the dietary diversity index. As far as the estimation technique is concerned, we adopted the Three Stage Least Squares (3SLS) regression. The regression estimates show that households' uptake of agricultural technologies has a significant positive effect on their dietary diversity and food consumption expenditure per capita due to increased farm production. While these results are consistent regardless of the gender of the household head, the extent of effects for female-headed households are almost twice those for male-headed households.

These findings underscore the need for the Ministry of Agriculture and its allied ministries such as the Ministry of Gender Affairs to ensure that the distribution of herbicides, pesticides, and inorganic fertilizer is gender inclusive. There is a need for a review of existing input subsidy policies to ensure a level playing field for both males and females. In addition to the advantage that males have over females in terms of the share and right of ownership of agricultural land (FAO, 2018), it appears from this analysis that females face some barriers in accessing pesticides and herbicides. It is therefore important that the government pays particular attention to the distribution of these inputs to make them more accessible to females to improve the quantity and quality of food production and consumption in their households.

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