

USAID/NIGERIA MARKETS II EX-POST STUDY



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ACRONYMS

ADP	Agricultural Development Program
CARI	Competitive African Rice Initiative
CYIS	cost, yield, and income survey
GIF	Gender Integration Framework
IITA	International Institute of Tropical Agriculture
LAPO	Lift Above Poverty Organization
LGA	local government area
MARKETS II	Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites II
M&E	monitoring and evaluation
MT/HA	metric tons per hectare
NIRSAL	Nigeria Incentive-Based Risk Sharing System for Agricultural Lending
WACOT	West African Cotton Company Limited

EXECUTIVE SUMMARY

This paper presents the findings of an ex-post study of USAID’s Maximizing Agricultural Revenue and Key Enterprises in Targeted Sites II (MARKETS II) project in Nigeria. This \$64.9 million project facilitated business partnerships between smallholder farmers and end-buyers in the processing segment of seven value chains. Complementing MARKETS II’s key strategy was its requirement that 50 percent of participants be women and 30 percent of participants be youth, along with its decision to reduce land-size requirements to increase inclusion and participation in agricultural markets.

A year after the project ended, Chemonics used a mixed-methods approach to assess post-project sustainability by reviewing monitoring and evaluation (M&E) data from 2012 to 2017, coupled with qualitative research in Nigeria among a small non-representative sampling of former beneficiaries, project stakeholders, and non-MARKETS II farmers. The ex-post objectives map the extent to which MARKETS II, a large-scale agriculture project, produced outcomes and impacts effecting smallholder farmer resiliency, with particular attention to women and youth; demonstrated gender and youth integration; and sustained activities more than one year after project end. In conducting the assessment through the lens of Feed the Future’s Gender Integration Framework (GIF), coupled with absorptive and adoptive resilience capacities like food security, productive assets, agricultural practices, financial assets, and market linkages, Chemonics identified smallholder farmer, women, and youth improvements across five capitals (human, financial, physical, natural, and social).

For the qualitative component, we facilitated 18 focus groups and 12 key informant interviews with farmer associations, extension agents, processors, and service providers in former project areas one year after project closure. Former MARKETS II technical staff selected and conducted the focus groups and key informant interviews. Therefore, there may be a perception that selected farmers and key informants were high-performing during MARKETS II. Due to time, resource, and security limitations, we only conducted on-site interviews in Kano and Kebbi, and we had to shift to phone interviews for Benue and Kaduna.

Our qualitative research revealed that MARKETS II’s beneficiaries continue to employ improved agronomic practices and have maintained or evolved market linkages. Women are expanding agricultural activities and diversifying business opportunities. Youth are investing in themselves, staying in rural areas, and creating niche business opportunities along the value chain, spreading technology and providing extension services. Sustained and evolving market linkages continue, and competition has built demand — three major rice processors now buy from Kebbi state, as opposed to just one prior to the project — and business-minded farmers sell within out-grower schemes and to the open market, depending on profitability. This research provides valuable information about sustained practices and activities one year after closeout of a large-scale USAID agriculture project.

INTRODUCTION

This report assesses the interrelated objectives of female and youth integration in agriculture, smallholder farmer resilience, and sustainability of improved agronomic practices and market linkages from the perspective of USAID/Nigeria's Agricultural Transformation Program's \$64.9 million flagship project — MARKETS II. This five-year, demand-driven agriculture market systems facilitation project took place in 26 Nigerian states (see Exhibit 1, next page). A year after the project ended, Chemonics evaluated MARKETS II's approach, drawing from life-of-project M&E data analyses, in-country key informant interviews, and focus-group discussions with former beneficiaries and stakeholders. This study highlights the results of our quantitative and qualitative findings, and demonstrates the key practices, market linkages, and increased incomes that beneficiaries continue to employ and derive from the project one year after MARKETS II closed.

Decades of value-chain research show that focusing on gender issues and investing in female farmers can increase production and productivity; expedite innovation adoption rates; raise household incomes; and lead to significant improvements in child health, nutrition, and education levels (Rozel Farnworth, 2011); (Ashby, et al., 2009); (Rubin, Manfre, & Nichols Barret, 2009); (Chicago Council, 2011). It is also necessary to increase women's asset ownership, boost women's household decision-making, and improve rural producer organizations' capacity to represent women's interests to ensure women develop and maintain presence across value chains (Rozel Farnworth, 2011); (Chicago Council, 2011). Focusing on youth as future farmers and off-farm service providers is also important because rural economic growth depends on agricultural development as well as youth serving as key contributors for improved natural resource management (Chicago Council, 2011); (IFAD, 2011).

Agricultural growth integrating women, youth, and resilient sustainable agricultural systems require their use of, and benefit from, improved technologies and practices. This study uses USAID's definition of resilience: "the ability of people, households, communities, countries, and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth" (USAID, 2013). We combine this definition with absorptive and adoptive resilience capacities, such as food security, productive assets, agricultural practices, financial assets, and market linkages. The American Journal of Evaluation notes that sustainability is achieved when the outcomes and impacts of an approach are maintained or expanded after the end of the project and withdrawal of project funding. In this sense, sustainability includes continued program activities, continued measured benefits for beneficiaries, and maintained market system capacity (Scheirer, 2005). Adapting Hartmann and Linn's definition, scalability is defined as the potential to expand, adapt, and sustain successful interventions over time to reach a greater number of people (Hartmann & Linn, 2008).

Smaller-scale agriculture projects have shown the possibility to link smallholder farmers, including marginalized groups like women, to modern integrated markets (Devaux, Torero, Donovan, & Horton, 2016). However, despite countries' interests in integrating small-scale farmers, gender considerations, and youth into resilient and sustainable agriculture, there is no evidence mapping the experiences of large-scale projects. This report provides this mapping to determine the extent to which MARKETS II effected smallholder farmer resiliency, with particular attention to women and youth; demonstrated gender and youth integration; and sustained activities more than one year after project end.

In the sections below, we describe the Nigerian context in which MARKETS II operated and detail our project implementation. We also provide a brief discussion of Feed the Future's GIF and project resilience. Then, we present the methodology and limitations of this ex-post evaluation and briefly describe the methodologies used for MARKETS II's baseline; endline; and cost, yield, and income surveys (CYIS), which form the basis of our quantitative analysis. Our results section presents the ex-post's quantitative and qualitative analysis. The final section provides summary discussions of gender and youth, resilience, and sustainability.

Exhibit 1. MARKETS II's Areas of Intervention



BACKGROUND

A. Nigeria Context

Inefficient market dynamics and intermittent conflict have impeded Nigeria's ability to produce enough commodity, staple, and nutritious food crops for its people while serving regional markets and producing inclusive, sustainable agriculture-led economic growth. Although agriculture, forestry, and fishing constitute approximately 20.8 percent of gross domestic product (World Bank, 2017) and 36.5 percent of labor (World Bank, 2017), Nigeria's poverty rate is around 53.5 percent (World Bank, 2009). With the 2008 oil price crash, the Nigerian government targeted agriculture to reduce rural poverty and increase food security. As Nigeria and its partners plan another decade of investment for millions of smallholder farmers, it is critical to learn from the successes and failures of USAID investments for improved economic and nutrition outcomes. In addition, Nigeria is of vital importance to the region as an engine of regional economic growth, given its multinationals, processors, and exporters of raw and processed commodities and resources.

B. MARKETS II PROJECT DESCRIPTION

MARKETS II worked in the cocoa, aquaculture, rice, sorghum, cassava, maize, and soybean value chains from April 2012 to October 2017 via private sector-driven value chain facilitation and market development. The project's systemic approach addressed limitations and opportunities in value chain segments that could have an impact on smallholder farmers' food security and income. A key element of MARKETS II's strategy was to facilitate longer-term "win-win" business partnerships by serving as an "honest broker" with end-buyers¹ in the processing segment of the value chain. Complementing MARKETS II's key strategy was its 50 percent women and 30 percent youth participation requirement as "networked" farmers (farmers who participated in MARKETS II interventions). Additionally, the project reduced its initial participation criteria of having one to five hectares to less than one hectare to meet these inclusion requirements.

Supporting end-buyer out-grower schemes, project staff helped buyers define their needed quality and quantity of raw materials, while also assisting farmers to meet those requirements and sell their products profitably. To ensure farmers could meet the requirements, MARKETS II mobilized buyer-linked NGOs and private intermediary firms — such as seed and fertilizer firms, farm implement providers, extension services, and credit providers — to collaborate with government extension agents to provide project-sponsored training and capacity building programs. Pre-season, in-season, and harvest/post-harvest step-down training programs introduced farmers to the importance of using high-quality inputs, proper planting techniques, productive agricultural equipment and technology, timely fertilizer application and irrigation scheduling, and harvest/post-harvest handling techniques. These techniques were presented in a "package of practices," an easy-to-understand and easy-to-apply set of procedures designed to ensure higher yields and higher product quality.

By putting high-quality, low-cost appropriate technologies and best practices in the hands of hundreds of thousands of rural poor and smallholder farmers, while linking them to demand-driven private sector partners, MARKETS II aimed to improve productivity, incomes, resilience, and access to diverse quality food. The project played a key role in scaling up agricultural technology interventions across aquaculture, cassava, cocoa, maize, rice, sorghum, and soybean value chain production systems to meet market demand, while contributing to more inclusive, resilient, and sustainable agricultural growth.

¹ Commonly known as "off-takers" in Nigeria.

GENDER INTEGRATION FRAMEWORK AND RESILIENCE

Although MARKETS II was not designed specifically to address Feed the Future's GIF, the framework is useful in evaluating MARKETS II's contributions to women's and young people's inclusion in sustainable, productive agriculture, and to smallholder farmer resiliency. Exhibit 2 includes seven dimensions contributing to the economic status of poor households, improved nutrition and health, and increased agricultural productivity.

Exhibit 2. Feed the Future's GIF

Desired Outcome	Definition of Outcome	Indicators to Track Progress Toward Outcome
Increased decision-making power in agricultural performance	Beneficiaries engage in decision-making processes within the home, either solely or jointly. Beneficiaries have increased autonomy in relation to productive activity.	<ul style="list-style-type: none"> • Input in productive decisions • Autonomy of production
Increased control over productive resources	Beneficiaries increase their ownership of, access to, and decision-making power over productive resources.	<ul style="list-style-type: none"> • Ownership of assets • Purchase, sale, or transfer of assets • Access to and decisions on credit
Increased control over use of income	Beneficiaries increase their control over use of income and have adequate control over and are engaged in decisions about use of household income.	<ul style="list-style-type: none"> • Control over use of income
Increased social capital and leadership in the community	Beneficiaries have increased social capital, improved social networks, and increased voice/agency within their communities.	<ul style="list-style-type: none"> • Group member speaking in public • Number of jobs created due to U.S. government assistance (sex disaggregated) • Number of organizations receiving U.S. government assistance (women's organizations disaggregated)
Improved time use/decreased time poverty	Beneficiaries have more time for desired productive and domestic tasks, leisure activities, and goal-setting	<ul style="list-style-type: none"> • Workload • Leisure
Increased human capital	Beneficiaries increase their technical skills and knowledge in activities that can improve their economic or social situation.	<ul style="list-style-type: none"> • Number of individuals receiving short-term training (sex disaggregated) • Number of individuals receiving long-term training (sex disaggregated)

Desired Outcome	Definition of Outcome	Indicators to Track Progress Toward Outcome
Increased access to and use of technologies	Beneficiaries have more and better opportunities to access technologies and use them in their economic/agricultural practices.	<ul style="list-style-type: none"> • Number of farmers applying new technologies and management practices (sex disaggregated)

Source: Feed the Future, 2014

Life-of-project data enables gender and youth analyses against the GIF dimensions that contribute most directly to increased agricultural productivity at the household level: decision-making on production, productive resources, human capital, and technology (Hillesland, 2016). It also allows for analysis of empowerment and leadership vis-à-vis public speaking.

We overlap and expand the GIF analysis to reflect on smallholder farmers' absorptive and adaptive capacities that effect their resiliency, such as food security, productive assets, agricultural practices, financial assets, and market linkages (Feed the Future, 2017a); (Feed the Future, 2017b); (Vaughan, 2018). We incorporate a livelihood asset-based approach considering five capitals: human, social, natural, physical, and financial (Donovan & Stoian, 2012). Through quantitative and qualitative data, we explore whether MARKETS II contributed to households and their agribusinesses, and whether it initiated greater access to these capitals to improve their well-being, household resilience, economic viability, and performance (Donovan & Stoian, 2012); (McKay, 2009); (Carter & Barrett, 2006). Data explored in the results section include food security, productive assets, agriculture practices, yields, access to and use of technologies, business skills, and market linkages (Vaughan, 2018); (Bizikova, Waldick, & Larkin, 2017).

EX-POST STUDY METHODOLOGY

The review team's mixed-methods ex-post research consisted of quantitative data analysis using the project's baseline, endline, and annual CYIS data sets. In November 2018, more than one year after the project's technical activities ended, the ex-post research team conducted qualitative focus-group discussions and key informant interviews to evaluate the sustainability of agronomic practices and market linkages.

A. Baseline and Endline Surveys During the Life of the Project

We used a household cross-sectional survey design for MARKETS II's baseline and endline surveys. The design employed direct observation and questionnaire administration to collect socioeconomic and housing data from targeted populations. Data collection included focus-group discussions, key informant interviews, on-site direct observation, and semi-structured interviews. MARKETS II hired a survey firm to collect the qualitative and quantitative data from a broad range of stakeholders and beneficiaries to ensure the neutrality of the process.

The baseline and endline surveys used two questionnaires approved by USAID's Monitoring and Evaluation Management Services. These were: 1) the household income and expenditure questionnaire, and 2) the yields, gross margins, and other agricultural practices questionnaire. The questionnaires' design considered MARKETS II's outcome and impact indicators, with household income, gross margin, yields, management practices, and food security identified as major factors to illustrate the project's impact.

A multi-stage sampling methodology used region, state, local government area (LGA), and household stages, sampling from LGAs for direct beneficiaries (intervention zones) and LGAs for indirect beneficiaries (non-intervention zones). MARKETS II farmers formed a sampling frame in intervention areas. Simple random household sampling at the LGA level selected respondents that did not directly participate in MARKETS II activities. The quantitative data-collection tool was administered at the household level.

B. Annual Cost, Yield, and Income Surveys

MARKETS II's M&E team compiled annual CYIS data from 2012 to 2017 for targeted value chains across the project's targeted states. The CYIS covered representative samples of farmers drawn from a population of MARKETS II registered farmers in all states where the survey took place. Sampling occurred at value chain and regional levels, using a 90-percent confidence level with a margin of error of 10 percent for all value chain commodities. Regions considered for sampling included the Middle Belt, Northern, South-West, and South-South (Niger Delta) regions. We used a random sampling methodology to select farmers for interviews and considered state, LGA, age, and sex.

MARKETS II service providers primarily conducted pen-and-paper surveys in the field, with agents asking about income, farm size, use of crop-protection products, and access to labor to assist with their farm. Data clerks then entered survey responses into Excel spreadsheets and submitted them to MARKETS II's M&E staff for validation.

M&E staff randomly selected commodities and states to collect the same CYIS data to validate service providers' data through comparative analysis. For example, the validation exercise confirmed that interviewed farmers were from the original sample and that the farms' GPS coordinates confirmed the location and farm size. Additionally, the M&E team weighed grain bags, when available, to confirm survey yield data because the size and weight of the bags varied between states and communities.

For the purposes of this study, we reviewed rainfed and irrigated rice as an exercise in information triangulation, considering rice's flagship status on the project. Limited resources combined with challenges in inconsistent data sets did not allow us to expand analysis to additional commodities.

C. Ex-Post Evaluation Methodology and Limitations

MARKETS II collected a wide array of data throughout the project. A year after the project closed, we capitalized on this data availability to apply a mixed-methods approach to critically evaluate the project's success and sustainability. We analyzed baseline, endline, and CYIS data using a variety of statistical methods, and conducted focus-group discussions and key informant interviews in the field to triangulate data findings.

Quantitative analyses tested changes in productivity, food security, asset holdings, and access and uptake of agricultural technologies, which included pooled multivariate regressions with combined baseline and endline data, as well as propensity score matching regressions. Additionally, graphs and descriptive statistics checked data to examine for outliers, non-plausible responses, and data coding errors. In creating the multivariate pooled regressions, we included independent variables in the specifications to control for survey year (baseline versus endline), gender, age, education, and MARKETS II participating farmers. Since non-MARKETS II farmers were living in areas near MARKETS II farmers, it is not appropriate to view them as a true control or comparison group. We see the non-MARKETS II farmers as indirect project beneficiaries for three main reasons: 1) project staff observed information sharing and spillover effects from MARKETS II training events and demonstrations to non-MARKETS II farmers; 2) the MARKETS II project design included establishing agriculture demonstration plots in non-MARKETS II targeted LGAs; and 3) MARKETS II regularly shared and trained local organizations and other project staff on MARKETS II's agronomic practices materials.

Given the lack of a true control, we can answer questions about gains and improvements in dependent variables over time for MARKETS II participants and non-MARKETS II farmers for variables like yields, technologies adopted, food security, and assets. We can also answer questions like, "Did female farmers see yield improvements over the project period?" In addition, were any improvements for female farmers of the same magnitude as male farmers? We interpret these quantitative regression results as descriptive regressions providing evidence about the project rather than impact results that prove MARKETS II's level of impact. As noted above, we do not have a control group or comparison group to conclusively identify the impact. Further, there are likely unobserved factors, such as national-level enabling environment factors, including the rice policy and import duties, that may have affected the results and contributed to the effects we observed. We feel that favorable policy-level changes in Nigeria combined with MARKETS II's interventions generated some of the positive productivity improvements documented in this report.

The qualitative research involved 18 focus-group discussions and 12 key informant interviews in former MARKETS II zones of intervention. While the research team conducted these interviews to assess sustained practices, market linkages, and the impact of MARKETS II interventions on smallholder farmers (especially women and youth) one year after the project closed, this research component did have a variety of limitations. First, the research team did not have the resources to conduct focus groups with a representative sample of farmers from each value chain supported by MARKETS II. Focus groups and key informant interviews were chosen by two Nigerian consultants in the field who served as former MARKETS II technical staff. Therefore, there may be a perception that farmers and key informants selected were high-performing during MARKETS II. Additionally, the initial plan characterized Kebbi and Kaduna as key states for the ex-post study — Kebbi was the project's flagship rice state and Kaduna had the highest concentration of MARKETS II farmers (more than 80,000) and four targeted value chains. However, time constraints due to a shifting security situation led to eliminating Kaduna and reworking farmer group meetings. This resulted in a semi-self-selection based on farmer and key informant availability and willingness to meet on short notice, leaving only one known high-performing group (Kiru in Kano state) in the focus-group discussion list. It also resulted in a higher number of rice groups rather than more soy, sorghum, and maize groups as planned.

Additionally, the consultants only interviewed one non-networked group, so there were fewer opportunities to compare more broadly how non-networked groups fared compared to networked groups. However, in most focus groups, non-networked farmers joined the conversation as observers and often signaled their agreement with networked farmers' comments. While the fluid security situation limited the LGAs that we could visit, the consultants supplemented their experiences with phone calls to key informants in Kaduna and Benue. Therefore, this study does not consider any farmers' experiences outside of the four states the ex-post study reached. The

two consultants involved in the field research were former MARKETS II staff. Although they were chosen for their deep project knowledge and their prior experience conducting similar exercises, they could be perceived as non-objective facilitators. We mitigated this through focus-group discussion and key informant interview recordings to ensure a transparent qualitative data set. In addition to the recordings, the notetaker wrote down all responses as exactly as possible. Due to time constraints, the researchers did not write exact transcripts of each discussion.

Prior to sending the two consultants to the field, Chemonics' home-office research team prepared two orientation sessions: one for the lead facilitator, and another for both the lead facilitator and the notetaker. These sessions explained the importance of asking probing questions; encouraging quieter members of the focus group to participate and share their stories; and taking clear notes that attribute quotations to men, women, or youth and capture conversational nuances. The orientation discussed the importance of meeting with MARKETS II networked and non-networked farmers, in addition to organizing "ideal" focus-group discussion composition to include half women and one-third youth participation, where possible. The orientation also reviewed the discussion guides and addressed consultants' questions about leading field discussions.

Once in the field, the consultants regularly shared their notes and updates on their in-country movements with the home-office research team. They contacted farmers' associations and cooperatives to conduct 10 focus-group discussions in Kebbi and eight focus-group discussions in Kano over the course of two weeks.

The consultants also organized several key informant interviews with former MARKETS II stakeholders, including two in Kaduna, one in Benue, four in Kebbi, and five in Kano. Kaduna and Benue key informant interviews were conducted over the phone.

Each focus-group discussion was 90 minutes to two hours long, with a facilitator and a notetaker to drive the discussion and record the meeting. In general, eight to 13 farmers participated in each focus group (although some groups had people join the discussion during the meeting) and each signed consent forms and marked their attendance. Key informant interviews were conducted similarly, but generally took less time.

We then analyzed the results by coding each focus-group discussion and key informant interview to better organize quotations and identify patterns, regional variation, or atypical responses. Coding allowed us to examine the frequency or extensiveness of topics discussed across focus-group discussions. Findings generally supported data collected throughout the life of the project and illustrated trends in the overall sustainability of MARKETS II's practices and approaches (see the results section, next page, for more information).

RESULTS

Quantitative MARKETS II data evaluated performance throughout project interventions. The research team supplemented this with qualitative data collection one year after MARKETS II’s closeout to follow up on sustained market linkages, technology uptake, and resilience. While the MARKETS II project was not explicitly designed to address the GIF or resilience, there appear to be sustained positive outcomes in terms of women-led and youth-led businesses and farms, household financial and food security, and sustained economic successes stemming from continued and evolving market linkages.

A. Increased Decision-Making Power in Agricultural Production

To measure increased decision-making power in agricultural production, we examined the baseline and endline data from MARKETS II, looking at questions concerning who is responsible for managing specific value chains. The surveys asked about the management of seven types of value chains for MARKETS II interventions: maize, cassava, sorghum, soybean, cocoa, rice, and aquaculture. Respondents answered if the person responsible for the value chain is a man, woman, or if both managed the value chain. Over the life of the project, female farmers reported that they were responsible for the value chain by 12 percentage points (from 32.6 percent of women at the baseline to 54.1 percent of women at the endline; see Exhibit 3 below). However, when we examined this variable for youth, we found a low number of observations, which precluded drawing conclusions about this change over the life of the project for young people.

Exhibit 3. Value Chain Management Responsibility

Who is Responsible for Managing Specific Value Chains	Baseline <i>Frequency Column Percentage</i>	Endline <i>Frequency Column Percentage</i>	Total <i>Frequency Column Percentage</i>
Male	93 36.61	74 35.41	167 36.07
Female	83 32.68	113 54.07	196 42.33
Both	78 30.71	22 10.53	100 21.60
Total	254 100	209 100	463 100

B. Increased Control Over Productive Resources

Across all 18 focus-group discussions in Kebbi and Kano, farmers attributed their increased productive resources (assets) and increased disposable income to the practices they learned — and market linkages they made — through MARKETS II. In particular, women cited the importance of improved farming and business practices in their ability to purchase upgraded homes, pay for their children’s schooling, and contribute to their husbands’ income to diversify their households’ business portfolio. One young woman in Kebbi state noted, “I bought a 400,000 NGN tricycle for commercial transportation for my husband and bought myself a tomato grinding machine for commercial purposes and a 100,000 NGN deep freezer to sell cold drinks. These have helped generate additional funds in our family. My family now has multiple sources of income as a result of the profit I made from selling rice.” An all-women’s rice group in Kano highlighted its increases in similar productive assets. One woman stated, “I paid 500,000 [NGN] for a plot of land to build my house. I have a house where I collect rent from tenants.” In most cases, farmers used their increased income from agriculture to invest in new businesses or

assets to generate additional cash flow. Most of the women we interviewed used the income from new assets to pay for their children’s school. Children and youth thus directly benefitted from their parents’ increased wealth.

Young farmers we interviewed also benefitted from an overall increase in wealth and continue to reinvest in new assets or in their own human capital. One young male farmer shared his recent purchases in Kebbi: “I bought three bulls for 350,000 NGN and eight sheep for 180,000 NGN.” With agriculture as his core business, this young man was able to diversify his assets to include income-generating livestock. The bulls and sheep may also be used to diversify his family’s nutrition.

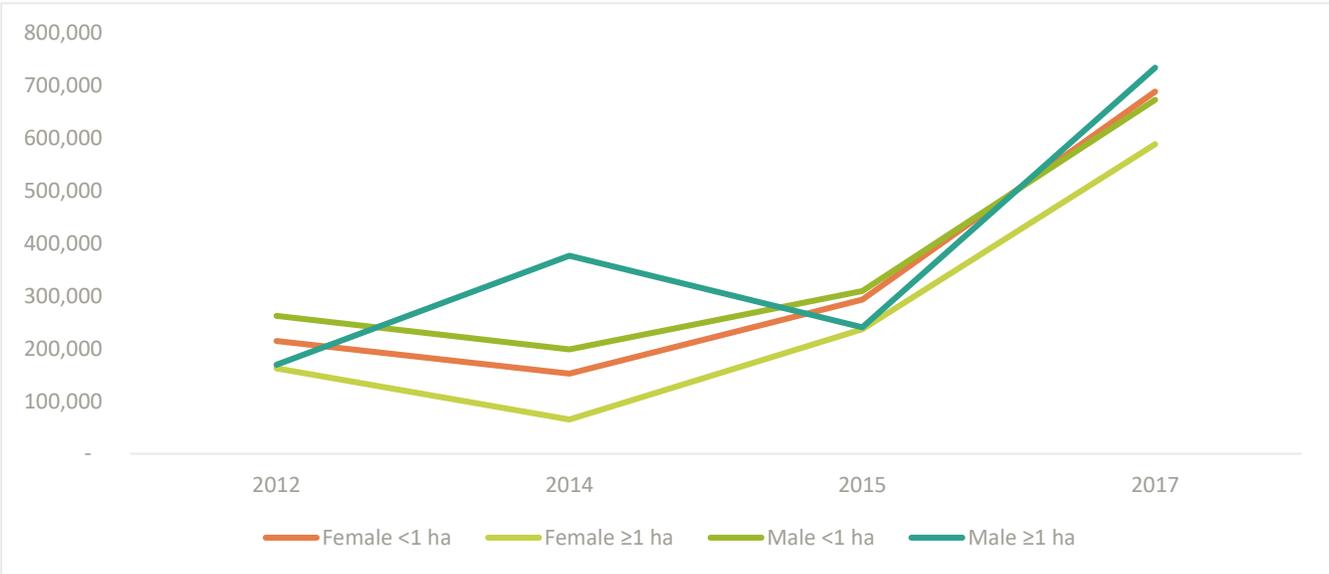
In addition to increased control over productive resources among women and youth, former migrant laborers were able to purchase plots of land and create a business for themselves in Kebbi instead of continuing to travel to find employment. One adult male farmer in Kebbi noted his community’s increased stability: “We have witnessed a reverse in rural-urban migration. Our men who travelled to other states and countries for manual labor are back in the community making money from agriculture.” In the same farmers’ group, a former male migrant worker said, “I have seen progress in my business since MARKETS II ended. I bought three plots of land for 600,000 NGN, 900,000 NGN, and 350,000 NGN, respectively. I farm upland crops on this land. I am also a businessman and I reinvested my rice profit in my business. I now buy paddy and cotton seed from Benin [to supplement my assets].” As the community thrived on practices taught by MARKETS II, they experienced less emigration, increased stability, and an uptick in asset ownership by migrant laborers.

C. Increased Control Over Use of Income

We used descriptive statistics to identify trends in rainfed and irrigated rice from the CYIS in net income per hectare among female farmers with less than one hectare of land, female farmers with one or more hectares of land, male farmers with less than one hectare of land, and male farmers with one or more hectares of land.

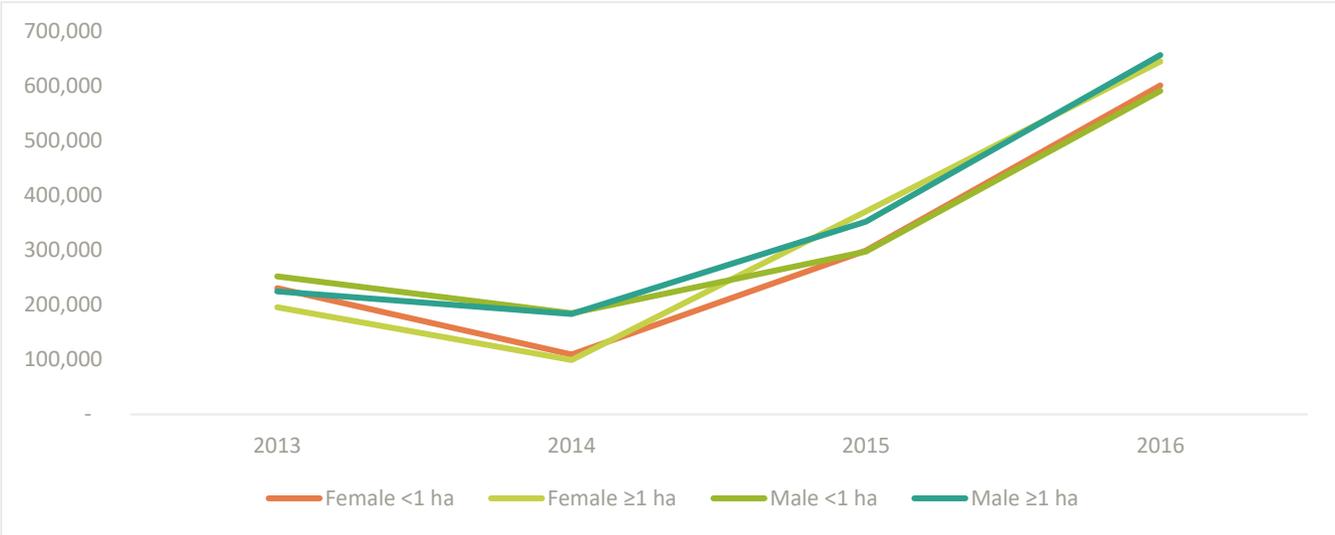
For rainfed rice on average, male farmers with one hectare of land or more fared better than the other three groups by experiencing an increase in net income by 334 percent between 2012 and 2017. However, all farmer types increased their net income by 244 percent during the same period. Although 2014 showed a dip in earnings, the overall trend edged upward throughout the project. This does not account for inflation and fluctuations in the value of the Nigerian naira (see Exhibit 4 below).

Exhibit 4. Average Net Income Per Hectare, Rainfed Rice (2012-2017)



For farmers who grew irrigated rice in the dry season (see Exhibit 5 below), net income per hectare increased by 179 percent on average across all four farmer types between 2013 and 2016. By 2016, men’s net income per hectare was slightly higher than that of women. However, women with one hectare or more showed the largest increase at 229 percent over the life of the project. Again, this does not account for inflation and fluctuations in currency value between 2012 and 2016.

Exhibit 5. Average Net Income Per Hectare, Irrigated Rice (2012-2016)²



Qualitative data mostly corroborated the net income per hectare data from the CYIS, but it also shed light on nuances among men, women, and youth. In our interviews, former MARKETS II beneficiaries cited improved business and financial management acumen gleaned from the project, which increased their annual incomes. One adult male farmer in Kebbi said, “The most important change for me is my ability to plan in sequence and ability to know my cost of production against my revenue. I am able to calculate my profit or loss easily.” Similarly, in direct response to how farmers have used their additional income derived from farming, one adult male farmer in another Kebbi group said, “I have given my wife a startup capital, 40,000 naira, to start the processing of soybean. The business has yielded two bulls for my wife.” Thus, while the CYIS tells a story of men making more income on average compared to women, the qualitative interviews suggest that many male farmers are using their additional income to benefit their families by supporting their wives’ business endeavors.

Women in an all-women’s rice cooperative in Kebbi have developed and maintained a higher degree of autonomy over their income. A widow in the rice cooperative said, “I have five children. My son has completed a Higher National Diploma, and my daughter is in her final year in the university. I am able to sponsor my children to higher institutions as a widow without depending on anyone.” As a widow, she is able to provide a stable source of food for her children, while also supporting her daughter’s education to empower her financially and socially.

Youth in former MARKETS II-networked groups have also reinvested their additional income from farming into diverse business opportunities. A young male farmer in Kebbi said, “I have made progress because my rice farming business has expanded. That red Peugeot 206 parked over there was bought at 700,000 NGN from wet and dry season farming. I have two shops where I sell provisions in one and grains in the other. I also use the car to travel to different villages to sell fabrics on market days.” This young farmer used MARKETS II’s improved agricultural practices and doubled his harvests by farming in both wet and dry seasons. He now has other small

² The irrigated rice data series had a data quality issue for women with >=1 hectare. The data point was corrected because it seemed a simple data error.

businesses as additional income sources to support him through climate or economic shocks. Similarly, in Kano, farmers’ groups that worked with MARKETS II on sorghum have diversified their crops, ensuring they are more resilient to intermittent shocks. A young man in Kano said, “I usually depend on wheat farming but when MARKETS II trained me, I now focus on sorghum and maize production and I get more profit. Most of my peers who insisted on producing wheat only have joined in producing maize and sorghum because they have seen we made a lot of profit.” This suggests that farmers are investing their additional income in other crops or other businesses that will lead to overall increased assets and income, an ability to absorb and mitigate shocks, and improved social standing.

D. Increased Social Capital and Leadership in the Community

A key dimension of social capital and leadership in the community is an individual’s ability to confidently participate in community discussions about critical topics, such as infrastructure, agricultural price-related issues, and abuse of power and corruption. To measure MARKETS II’s influence on this dimension of gender and youth integration, we examined three questions in the baseline and endline survey:

- Do you feel comfortable speaking up in public to help decide on infrastructure (e.g., wells, water supplies, and roads) to be built in your community?
- Do you feel comfortable speaking up in public to help decide on price-related activities (e.g., inputs, produce, and child labor) in your community?
- Do you feel comfortable speaking up in public against abuse of power (e.g., corruption, allocation of resources, and favoritism) in your community?

Respondents answered using a five-point scale ranging from “No, not at all comfortable,” “Yes, with a great deal of difficulty,” “Yes, but with a little difficulty,” to “Yes, fairly comfortable,” and “Yes, very comfortable.”

In analyzing the three social capital and influence questions, we examined baseline and endline responses for women. For each of the three questions, women at the endline were more likely to report being very comfortable speaking up in public. For example, baseline responses for infrastructure showed that 43.7 percent of women reported feeling very comfortable speaking up in public; at the endline, this percentage rose to 56.7 percent (see Exhibit 6 below). We observed increases of a similar magnitude for questions about price-related topics and abuse of power (see Exhibits 7 and 8, next page). However, women’s increased comfort regarding speaking up about abuse of power was less significant, rising from 46.6 percent at baseline to 52.1 percent at endline.

Exhibit 6. Women’s Comfort with Public Speaking (Infrastructure)

Q. 508: Do you feel comfortable speaking up in public to help decide on infrastructure (e.g., wells, water supplies, and roads) to be built in your community?	Baseline	Endline	Total
	<i>Frequency Column Percentage</i>	<i>Frequency Column Percentage</i>	<i>Frequency Column Percentage</i>
No, not at all comfortable	43 8.5	43 10	86 9.19
Yes, but with a great deal of difficulty	73 14.43	41 9.53	114 12.18
Yes, but with a little difficulty	73 14.43	44 10.23	117 12.5
Yes, fairly comfortable	96 18.97	58 13.49	154 16.45

Q. 508: Do you feel comfortable speaking up in public to help decide on infrastructure (e.g., wells, water supplies, and roads) to be built in your community?	Baseline <i>Frequency Column Percentage</i>	Endline <i>Frequency Column Percentage</i>	Total <i>Frequency Column Percentage</i>
Yes, very comfortable	221 43.68	244 56.74	465 49.68
Total	506 100	430 100	936 100

Exhibit 7. Women's Comfort with Public Speaking (Price-Related Topics)

Q. 509: Do you feel comfortable speaking up in public to help decide on price-related activities (e.g., inputs, produce, and child labor) in your community?	Baseline <i>Frequency Column Percentage</i>	Endline <i>Frequency Column Percentage</i>	Total <i>Frequency Column Percentage</i>
No, not at all comfortable	35 6.92	43 10	78 8.33
Yes, but with a great deal of difficulty	62 12.25	42 9.77	104 11.11
Yes, but with a little difficulty	76 15.02	44 10.23	120 12.82
Yes, fairly comfortable	107 21.15	63 14.65	170 18.16
Yes, very comfortable	226 44.66	238 55.35	464 49.57
Total	506 100	430 100	936 100

Exhibit 8. Women's Comfort with Public Speaking (Abuse of Power)

Q. 510: Do you feel comfortable speaking up in public against abuse of power (e.g., corruption, allocation of resources, and favoritism) in your community?	Baseline <i>Frequency Column Percentage</i>	Endline <i>Frequency Column Percentage</i>	Total <i>Frequency Column Percentage</i>
No, not at all comfortable	41 8.1	57 13.26	98 10.47
Yes, but with a great deal of difficulty	59 11.66	43 10	102 10.9
Yes, but with a little difficulty	81 16.01	33 7.67	114 12.18
Yes, fairly comfortable	89 17.59	73 16.98	162 17.31

Q. 510: Do you feel comfortable speaking up in public against abuse of power (e.g., corruption, allocation of resources, and favoritism) in your community?	Baseline <i>Frequency Column Percentage</i>	Endline <i>Frequency Column Percentage</i>	Total <i>Frequency Column Percentage</i>
Yes, very comfortable	236 46.64	224 52.09	460 49.15
Total	506 100	430 100	936 100

When we examined the same questions for youth respondents (aged 29 and younger), we found a similar increase in confidence and comfort in speaking up about important topics in public. For example, at baseline, 42.9 percent of youth reported feeling very comfortable speaking up about infrastructure concerns; this number rose to 59.2 percent at endline. We also observed an increase in feeling very comfortable speaking up about price-related issues and against abuse of power (see Exhibits 9 to 11 below).

Exhibit 9. Young People’s Comfort with Public Speaking (Infrastructure)

Q. 508: Do you feel comfortable speaking up in public to help decide on infrastructure (e.g., wells, water supplies, and roads) to be built in your community?	Baseline <i>Frequency Column Percentage</i>	Endline <i>Frequency Column Percentage</i>	Total <i>Frequency Column Percentage</i>
No, not at all comfortable	6 5.04	12 12.24	18 8.29
Yes, but with a great deal of difficulty	17 14.29	12 12.24	29 13.36
Yes, but with a little difficulty	16 13.45	4 4.08	20 9.22
Yes, fairly comfortable	29 24.37	12 12.24	41 18.89
Yes, very comfortable	51 42.86	58 59.18	109 50.23
Total	119 100	98 100	217 100

Exhibit 10. Young People’s Comfort with Public Speaking (Price-Related Topics)

Q. 509: Do you feel comfortable speaking up in public to help decide on price-related activities (e.g., inputs, produce, and child labor) in your community?	Baseline <i>Frequency Column Percentage</i>	Endline <i>Frequency Column Percentage</i>	Total <i>Frequency Column Percentage</i>
No, not at all comfortable	4 3.36	13 13.27	17 7.83
Yes, but with a great deal of difficulty	13	12	25

Q. 509: Do you feel comfortable speaking up in public to help decide on price-related activities (e.g., inputs, produce, and child labor) in your community?	Baseline <i>Frequency Column Percentage</i>	Endline <i>Frequency Column Percentage</i>	Total <i>Frequency Column Percentage</i>
	10.92	12.24	11.52
Yes, but with a little difficulty	21 17.65	6 6.12	27 12.44
Yes, fairly comfortable	25 21.01	12 12.24	37 17.05
Yes, very comfortable	56 47.06	55 56.12	111 51.15
Total	119 100	98 100	217 100

Exhibit 11. Young People’s Comfort with Public Speaking (Abuse of Power)

Q. 510: Do you feel comfortable speaking up in public against abuse of power (e.g., corruption, allocation of resources, and favoritism) in your community?	Baseline <i>Frequency Column Percentage</i>	Endline <i>Frequency Column Percentage</i>	Total <i>Frequency Column Percentage</i>
No, not at all comfortable	10 8.4	18 18.37	28 12.9
Yes, but with a great deal of difficulty	14 11.76	11 11.22	25 11.52
Yes, but with a little difficulty	13 10.92	3 3.06	16 7.37
Yes, fairly comfortable	23 19.33	14 14.29	37 17.05
Yes, very comfortable	59 49.58	52 53.06	111 51.15
Total	119 100	98 100	217 100

E. Increased Access to and Use of Technologies/Increased Human Capital

We have used propensity score matching to estimate the effects of MARKETS II participation on farmers’ access to technology and technology utilization (see Exhibit 12, next page). With endline survey data, we examined the effects of MARKETS II participation on receiving training on crop protection within the past year, using seed testing/germination testing, utilizing recommended improved seed varieties, following recommended plant spacing, applying inorganic fertilizer, and conducting field operations at recommended times. Additionally, we examined the link between MARKETS II participation and establishing nurseries, applying pest management practices, applying recommended soil and water conservation practices, and using irrigation. The variables that

we used for matching were indicator variables for youth (age group); male/female; and educational attainment at the senior secondary, vocational school, technical school, or university level.

Exhibit 12. Propensity Score Matching Results: The Effects of MARKETS II Participation on Access to and Utilization of Agricultural Technologies

Technology Variable	Coefficient	Standard Error	T-STAT	P> z
Receiving training in crop protection in the past year	0.567657	0.021076	26.93	0.000
Using seed testing	0.087351	0.024906	3.51	0.000
Using improved seeds	0.050018	0.025437	1.97	0.049
Using recommended spacing	-0.02062	0.022677	-0.91	0.363
Applying inorganic fertilizer	-0.04155	0.025098	-1.66	0.098
Applying operations at recommended times	-0.07424	0.020986	-3.54	0.000
Establishing nurseries	0.004565	0.014698	0.31	0.756
Applying pest management approaches	0.010429	0.020561	0.51	0.612
Applying soil/water conservation (fertilizer)	0.010594	0.007115	1.49	0.137
Using irrigation	0.031151	0.01515	2.06	0.04

Note: Propensity score matching results for the effect of being a MARKETS II farmer on the likelihood of receiving training or practicing one of these approaches were matched upon the following variables: youth dummy, male/female, education (as measured by dummy variables for university, senior secondary, and vocational educational attainment).

Overall, propensity score results show that at project close (when the final survey was fielded), participation in a MARKETS II farmers' group was associated with statistically significant (at the 95 percent confidence level) increases in access to crop-protection training (56 percentage points higher than non-MARKETS II farmers), as well as increases in using seed tests (8 percentage points higher), utilizing improved seeds (5 percentage points more likely), and using irrigation (3 percentage points higher). For other agricultural technologies and approaches, we did not observe statistically significant differences between MARKETS II farmers and non-MARKETS II farmers (indirect beneficiaries). However, for one indicator, namely applying operations at the indicated time, MARKETS II farmers were 7 percentage points less likely to follow the recommended timings for operations. Since these propensity score matching results matched upon a dummy variable for sex, as well as a dummy variable for youth farmers, the average effects found apply to female and youth farmers.

On the qualitative side, focus groups and key informant interviews revealed trends in technology access and uptake: MARKETS II technology and farming practices continue to be disseminated formally by state and non-government actors and informally by former beneficiaries. In addition, youth are investing in themselves and creating niche business opportunities by providing services at specific points along the value chain, spreading technology in their communities via their businesses.

Since MARKETS II closed, states have made some effort to formalize the spread of improved practices and technologies. Two farmers' groups in Kebbi told us they provided demonstration training to other states' farmer representatives, as well as visiting officials. A male farmer in Kebbi stated, "In fact, the state used our group as a reference point in rice farming... As a result, Zamfara and Gombe state governments sent farmers' representatives from their states to learn dry season rice farming from us." A male farmer in another group in Kebbi said, "We have spread [seed transplanting] technologies even outside Kebbi state. I was one of the lead farmers that was selected by the state to teach farmers in Imo state [southern Nigeria] on rice production. The farmers in that state were appreciative, as they simply didn't know the best practices in rice cultivation."

In addition, several key informant interviews with Agricultural Development Program (ADP) extension agents revealed their continued state-mandated involvement in training rice farmers outside Kebbi. An extension agent in Kebbi said, "I have been to Imo state to train rice farmers. We were asked by our state government to provide technical training for the farmers in Imo and Niger states. I trained 150 extension agents and 500 farmers in Imo." Another extension agent (a rice specialist) in Kano was sent to train farmers in Yobe, Borno, and Jigawa states: "I learned the [rice] production and marketing process [from MARKETS II]. In addition to that, I was engaged by Yobe, Borno, and Jigawa states to train farmers on rice production... I have done training of trainers for 500 in Borno, 250 in Yobe, and 250 in Jigawa." State efforts to showcase MARKETS II farming groups' best rice cultivation practices signals the important influence these practices have had on state agriculture, as well as the government's increased prioritization of rice as Nigeria's flagship crop in recent years. It also demonstrates the status that MARKETS II rice farmers now hold as experts and educators in their line of work.

Extension agents have also trained non-networked farmers in their day-to-day jobs without traveling to other states. A female soybean extension agent in Kaduna expanded her reach, stating, "I shared what I learned with many non-MARKETS II farmers, and other extension agents have done the same. The farmers are adopting the MARKETS II technologies and on a scale of 10, they score 7. They are still trying to catch up with MARKETS II farmers because the MARKETS II-trained farmers also keep improving. My colleagues have also continued to reach non-MARKETS II farmers in the state, especially in the communities where they are resident. The extension agents have also acknowledged that non-networked farmers are rapidly adopting technologies like proper fertilizer application and plant spacing." A representative from Labana Rice Mills (a processor that MARKETS II linked to networked farmers' groups) added, "The technology promoted by MARKETS II in rice farming is being copied by non-MARKETS II farmers, and so we get high-quality grains from them. In addition, MARKETS II-trained farmers have continued to expand their production."

In addition to disseminating their knowledge beyond their home state and to non-networked farmers locally, extension agents and service providers continue to be hired by other non-governmental projects after MARKETS II closed. One male farmer in Kebbi said, "NIRSAL and CARI [the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending and the Competitive African Rice Initiative, two new farming projects] trained us in rice production and incidentally, NIRSAL used the same MARKETS II training manuals and former trainers to train us, while CARI did not bring anything different from what we already knew, so they only refreshed us." A service provider for extension work under MARKETS II in Benue also highlighted how he continues to benefit from project connections: "I am also a beneficiary because my new job with IITA [International Institute of Tropical Agriculture] is a result of the visibility and experience I received from MARKETS II partnering with Egalf Ventures Ltd." The capacity building that service providers and extension agents gained through MARKETS II has given them the experience and expertise to improve their chances of being hired by other projects for their agricultural expertise.

Former MARKETS II beneficiaries are also disseminating technology via informal channels, creating a "spillover effect" into communities that continue to benefit indirectly from MARKETS II support. One adult male farmer in Kebbi cited farm laborers who have shared MARKETS II practices on the job: "We not only shared practices like line planting with other farmers, but even our laborers after working on our farms spread the technologies when they are engaged by other farmers, who hired them because they saw the good results we get on our farms. As a result, even millet farmers in Jega now use correct spacing." Networked farmers who employ laborers train them on MARKETS II best practices. These laborers then informally spread the practices to other farms and laborers.

Several farmers' groups also cited a sense of communal responsibility in their decision to share practices and technologies. An adult male farmer in Kebbi said, "I personally have trained more than 50 non-networked farmers within the community. After seeing the vigorous crop on my demo farm and the higher yield after harvest, those who initially told us that transplanting one seedling was risky came to ask how we are doing it, and we shared the knowledge with them." For sorghum production in Kano, farmers trained young college students for free. An adult male farmer in Kano explained, "Students on attachment came from Audu Bako College of Agriculture to Kiru farmers for training on sorghum production. They did not pay us. It is part of our social responsibility." A farmers' group chairman in Kebbi also noted, "We have trained non-networked farmers in Kardi, Randani, and Harasawa [neighboring villages] in these technologies. They did not have to pay, and we didn't ask them to, because we also learned the technologies without paying. Now, all these improved practices are widespread."

Even a non-networked female farmers' group cited how MARKETS II indirectly influenced their farming practices. One female farmer in Kebbi said, "Prior to 2016, we were planting local varieties of rice, but in 2016, we started planting Faro 44 introduced to us by our chairperson. The chairperson knew about MARKETS II through a family member that belonged to a MARKETS II-networked group in town. It was from him that she got the knowledge of planting Faro 44 and other technologies, which she shared with her members." Although these women were not formally networked as MARKETS II beneficiaries, they benefited from this spillover effect, in which networked farmers informally spread improved technologies via their community and family networks.

Focus groups also highlighted increased youth investment in their own education, as well as increased engagement in niche areas along agricultural value chains. One young man in Kebbi said he was investing in his own education with additional income from farming and other assets: "Before MARKETS II, I could not further my education beyond high school; during MARKETS II, I made some money and enrolled in Waziri Umaru Polytechnic. I have completed my diploma program. After MARKETS II, I have enrolled in the same school to complete my Higher National Diploma. My education in a higher institution is self-sponsored using funds I earned from my farms." Other youth have taken advantage of the increasingly profitable agriculture sector by creating businesses for themselves as special service providers (e.g., fertilizer or urea super granule applicators and transplanters) along the value chain. A young man in Kano said, "I attended training at IITA to learn how to spray agrochemicals. I have trained 20 other youth in this community, so we have youth who earn a living from spraying agrochemicals on farms, in addition to owning our own farms." Another young man in Kebbi explained how he earns additional income by providing a niche service: "I transplant for other farmers at 200 NGN per 20 square meter basin. I earn as much as 1,000 NGN in a day transplanting for people." These activities along the value chain have helped alter the flow of rural-urban youth migration. More and more youth are remaining in their rural villages where they can make a better living than in the city. According to an adult male farmer in Kano, "Before MARKETS II, most of our youth go to the city during the off season. Now they stay to invest their profit from rice farming into other businesses and tangible assets."

F. Sustained and Evolving Market Linkages

Focus groups and key informant interviews also highlighted sustained and evolving market linkages one year after MARKETS II closed. For example, a group of sorghum-growing farmers in Kiru have expanded sales now to five companies. One male farmer in the group stated, "ICRISAT, Golden Flour Mills, Honeywell Flour Mill, Flour Mills of Nigeria, and Northern Flour Mills have worked with us since the end of MARKETS II." Not only has the group maintained its relationship with Honeywell, it has also developed business partnerships with other processors, expanding its potential sources of additional income. Another Kano sorghum group now supplies to two additional companies in the region, Premier Seed and Mirage. These relationships reflect MARKETS II groups' market linkage expansion, in addition to increased competition and market demand.

Such market linkages continue to evolve as the market changes. Overall, demands are higher in 2018 compared to the beginning of MARKETS II for rice, sorghum, maize, and soybean, especially since cross-border smuggling has decreased in recent years, building local demand for rice. Protectionist policies implemented by the Nigerian government complemented MARKETS II-facilitated linkages between smallholder farmers and processors,

helping to sustain them beyond the project. In 2015, the Nigerian government banned brown rice imports, allowing local processors to further develop a market base and sustain essential connections to farmers' groups.

These government policies, complemented by MARKETS II practices, may have contributed to overall increased demand for small-scale processing. This has also created new buyers. Key Nigerian processors like West African Cotton Company Limited (WACOT) and Labana continue to work with farmers' groups, yet these relationships have evolved as the market changed over the past two years. A male farmer in a farmers' group in Kebbi described continued financial support from WACOT and Lift Above Poverty Organization (LAPO), a microfinance institution: "During and after MARKETS II... LAPO and WACOT also gave us fertilizer. After the dry season harvest, we repaid LAPO and WACOT with our grains at the current rate. They deduct the loan value and pay us our balance."

Other farmers' groups, however, have changed their relationships with MARKETS II-facilitated partnerships to better respond to the open market's profitability. A women's group participant in Kebbi said, "We have actually become competitors with Labana, so we have very little to do with them. We also exhaust our paddy that we sometimes must buy from the open market to process... We buy an average of 1 ton per week for processing." Women from the Tungar Hauri Women's Rice Cooperative have become buyers for processors and mills, creating a "middle-man" system for themselves. This business decision suggests that the value of access to rice for the mills is quite high.

While market linkages with processors have evolved, there appear to be some challenges in further developing relationships with input providers to get seeds and agrochemicals. One ADP extension agent in Kaduna who worked with soybeans said, "Fertilizers and agrochemicals are not readily available. Seeds are available but there usually are not enough. Although the ADP does not sell inputs, farmers still come to us so we [extension agents] can link them to input dealers." This suggests that the market for inputs has not further developed, nor are input providers readily available for farmers in their communities. Farmers in Kano also said they increasingly buy their inputs from extension agents. One young female farmer said, "I have learned to source for improved seed variety and practice good post-harvest activities. I buy my seeds through the extension officers." While this could suggest that some extension agents are using their business acumen to pass along technology and provide inputs to add to their income, it could also signal a lack of availability of input providers, as discussed by the extension agent in Kaduna. Farmers still use extension agents as a resource for finding quality inputs.

G. Food Security and Household Resilience

To examine the links between MARKETS II and food security and household resilience, we conducted both quantitative and qualitative analyses. For quantitative analyses, we used the pooled baseline and endline surveys to estimate a set of linear probability models of the likelihood of answering positively to a question about food insecurity. The questions were:

- Was there a period during the months of March 2016 to February 2017 when you didn't have enough food for your household (produced or purchased)?
- In the past (four weeks/30 days), was there ever no food to eat of any kind in your house because of lack of resources to get food?
- In the past (four weeks/30 days), did you or any household member go to sleep at night hungry because there was not enough food?
- In the past (four weeks/30 days), did you or any household member go a whole day and night without eating anything at all because there was not enough food?

Exhibit 13. Pooled Regression Models (Linear Probability Models) of the Likelihood of Being Food Insecure

	Ever Not Had Enough Food	Ever Not Had Enough Food Within the Past Four Weeks	Ever Gone to Sleep Hungry Within the Past Four Weeks	Ever Gone Without Food for a Whole Day
	Coefficient STD. Error	Coefficient STD. Error	Coefficient STD. Error	Coefficient STD. Error
DFinal	-0.0637036 *** 0.0167434	-0.0539174 *** 0.0144645	-0.0685914 *** 0.0131152	-0.0649183 *** 0.0119298
DYouth	0.0097844 0.0309541	-0.0469101 * 0.0267364	-0.0000133 0.0242423	-0.0150359 0.0220512
DMARKETS II Farmer	-0.0892457 *** 0.0170593	-0.0426972 *** 0.0147404	-0.0274548 ** 0.0133653	-0.0098791 0.0121573
DFemale	-0.0040659 0.0171542	0.0111982 0.0148176	-0.0081862 0.0134354	0.0245178 ** 0.012221
DVocPolyTech	-0.030645 0.0224832	-0.0227915 0.0194204	-0.0614245 *** -0.0614245	-0.0596178 *** 0.0160173
DUniversity	-0.068293 0.0344789	-0.0548618 * 0.0297809	-0.0784586 *** 0.0270029	-0.0802474 *** 0.0245623
DSeniorSecondary	-0.0057864 0.0190664	-0.027295 0.0164693	-0.0442647 *** 0.014933	-0.045169 *** 0.0135833
Constant	0.4389705 *** 0.0135673	0.2721512 *** 0.0117205	0.2369518 *** 0.0106272	0.185431 *** 0.0096667
Number of Observations	3,864	3,863	3,863	3,863

Note: *** denotes statistical significance at the 1 percent level; ** denotes statistical significance at the 5 percent level; and * denotes statistical significance at the 10 percent level.

The pooled regression results for the food security questions are displayed in Exhibit 13 above. Please note that DFinal denotes an endline observation; DYouth indicates a respondent 29 years of age or younger; DMARKETS II Farmer indicates a farmer who was part of a MARKETS II group; DFemale indicates a female respondent; and DVocPolyTech, DUniversity, and DSeniorSecondary are educational attainment dummy variables.

For each of the food security questions, we observe a statistically significant improvement in the food security situation over the life of the project. It ranges from 6.85 percentage points (gone to sleep hungry within the past four weeks) to 5.39 percentage points (not had enough food within the past four weeks). This improvement is relevant for both MARKETS II farmers and farmers who were not part of a MARKETS II-affiliated group. Secondly, for three of the four food security questions, being a MARKETS II farmer is associated with an additional statistically significant protective food security effect. This improvement in food security ranges from 8.92 percentage points (not had enough food over the previous year) to 2.74 percentage points (gone to sleep hungry within the past four weeks). Lastly, these effects consider the protective influence of education (and correlated variables like income and assets). We see a statistically significant effect for the education dummy variables, especially for the regressions about going to sleep hungry or going an entire day without food. Overall, these results support and provide evidence of MARKETS II's role in generating statistically significant improvements in household food security in the project implementation area. MARKETS II farmers' food security improvements were significantly higher (about double) those of non-MARKETS II farmers.

Qualitative analyses yielded similar results. Farmers in our interview groups said they had enough harvest and diversified businesses to maintain food security at home one year after the project's end. A female farmer in a MARKETS II-affiliated farmers' group in Kano said her children are well-fed compared to before MARKETS II interventions: "Before MARKETS II, my family barely had enough food to eat. Six years later, there is food security in my home. My children are feeding well. There is enough food to sustain us until the next harvest season." Prior to MARKETS II interventions, food insecurity was the trend for agrarian families. During and after MARKETS II, interviewed farmers had progressed from subsistence farming to farming as a business — selling to the open market, making a profit on their harvest, and keeping enough food in storage to save for less-successful harvest periods. An adult female farmer in Kebbi said, "We store some of our grains for household consumption."

Across focus-group discussions, farmers also employed best agricultural practices and technologies on crops beyond the staple crops managed in MARKETS II training programs. These groups continue to diversify their food and nutrition sources by cultivating several crops instead of one. Members of one focus group in Kebbi explained that they employ some of the lessons they learned in rice farming to wheat. A male farmer in another focus group in Kebbi, which also learned about rice practices from MARKETS II, noted, "We introduced land preparation, use of seeds, and spacing in millet and sorghum, which we never did before."

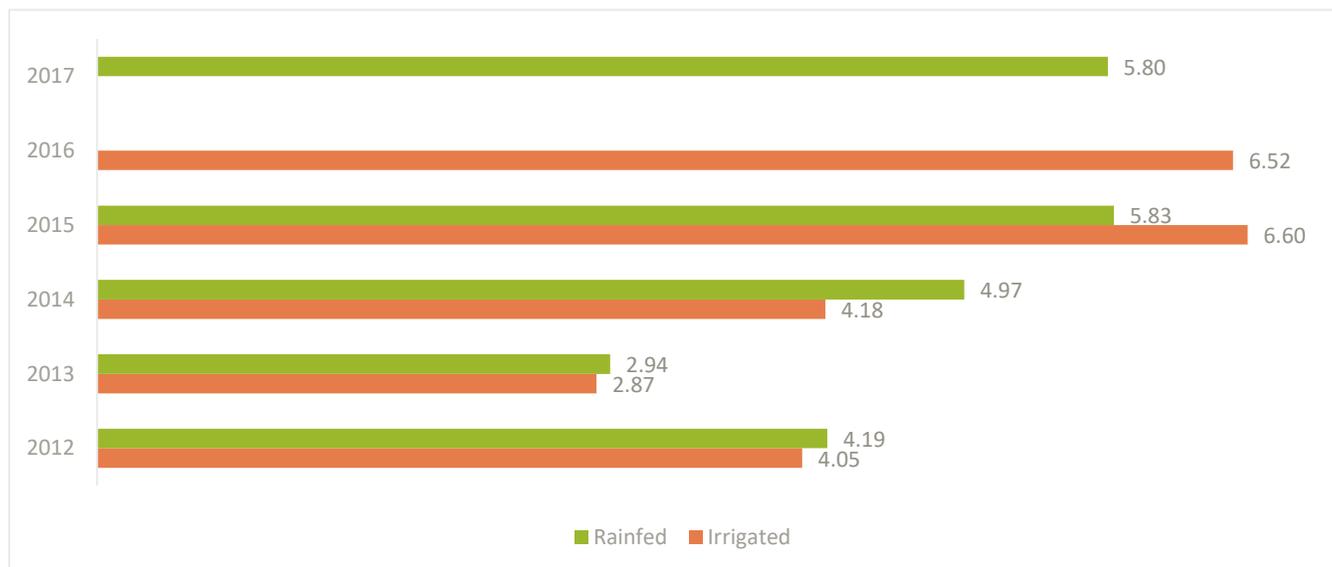
Interviewed farmers in Kebbi said they better absorb risks related to intermittent climate shocks due to MARKETS II practices. Three farmer groups in Kebbi said they experienced a flood during the wet season this past year. One male farmer said, "Simply put, our current status can simply not be compared to where we were six years ago [before MARKETS II] and we pray never to go back. We have no difficulty in having food reserves throughout the year; even with flood this year, we still didn't have hunger." MARKETS II also trained rice farmers how to manage multiple harvests a year to increase their families' food reserves. A male farmer in another Kebbi group affected by the flood stated, "Despite the flood we experienced, we still have the last dry season harvest in store, so we are not worried." Among those we interviewed, rice farmers continue to cultivate both wet- and dry-season rice to secure two or three annual harvests instead of just one, contributing to continued food security at home.

In addition, the all-women's farmers' groups we interviewed built their financial resilience through formal and informal savings programs. A farmer from one all-women's rice cooperative in Kebbi said, "Our cooperative saves some with commercial banks and in-house saving and loans with weekly/monthly contributions. When a member needs assistance, this is the first port of call." Women are thus not entirely dependent on their husbands or fathers for household savings; they are diversifying their savings portfolio by creating informal loans within the cooperative and by saving with a commercial bank. If the commercial bank closes, it is likely they will still have access to some informal reserves within their cooperative. Another all-female cooperative cited the importance of pooled savings to help each other in times of financial duress. A women in the cooperative noted, "We make financial contribution as a cooperative to save for the rainy day. We use the funds to support members who are not able to buy the required inputs for the next farming season."

H. Yields

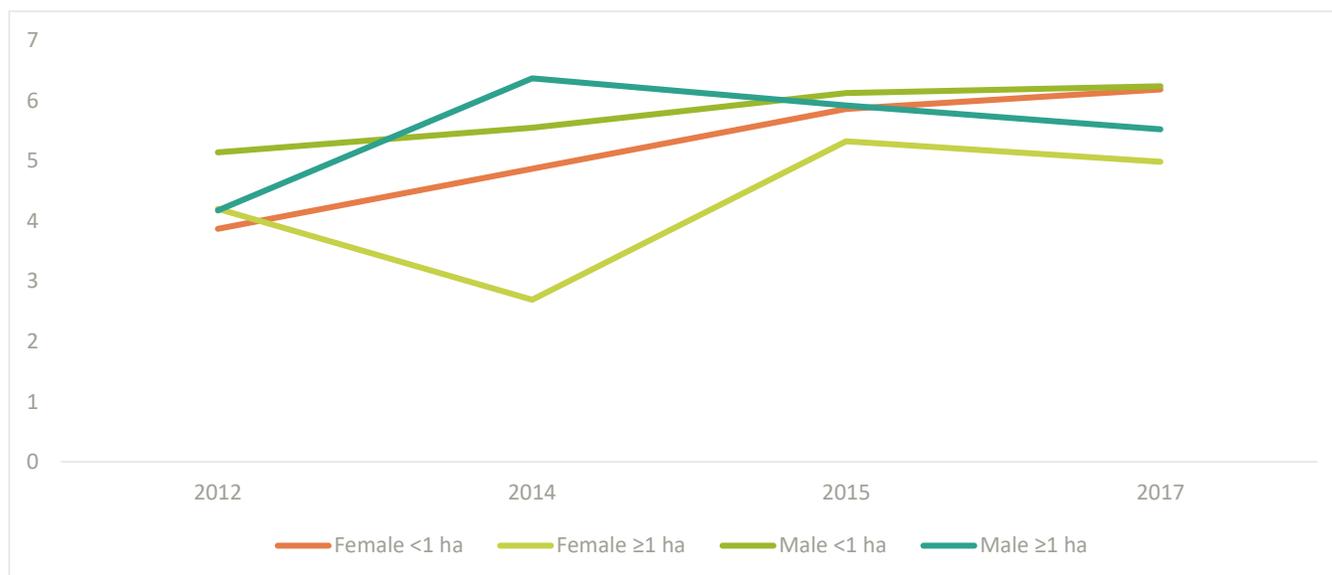
We used descriptive statistics to display trends in yields for MARKETS II-affiliated farmers. We only examined rainfed and irrigated rice yields as recorded in the CYIS. According to the CYIS for rainfed and irrigated rice, the average yield of irrigated rice increased from 4.04 metric tons per hectare (MT/HA) in 2012 to 6.52 MT/HA in 2016, with the highest recorded at 6.6 MT/HA in 2015. Average yields also increased for rainfed rice (from 4.19 MT/HA in 2012 to 5.8 MT/HA in 2017; see Exhibit 14, next page). While data was recorded for 2016 rainfed rice and 2017 irrigated rice, the research team was unable to find completed datasets to aggregate data for this analysis.

Exhibit 14. Average Yields (MT/HA), Rainfed and Irrigated Rice (2012-2017)



We also used descriptive statistics to identify trends in rainfed and irrigated rice yields from the CYIS among female farmers with less than one hectare of land, female farmers with one or more hectare of land, male farmers with less than one hectare of land, and male farmers with one or more hectares of land. There were no male observations in 2013, so it was not included in this analysis. Women with less than one hectare of land (likely more marginalized farmers) saw their yields increase by 60 percent on average, from 3.87 MT/HA in 2012 to 6.19 MT/HA in 2017 (see Exhibit 15 below).

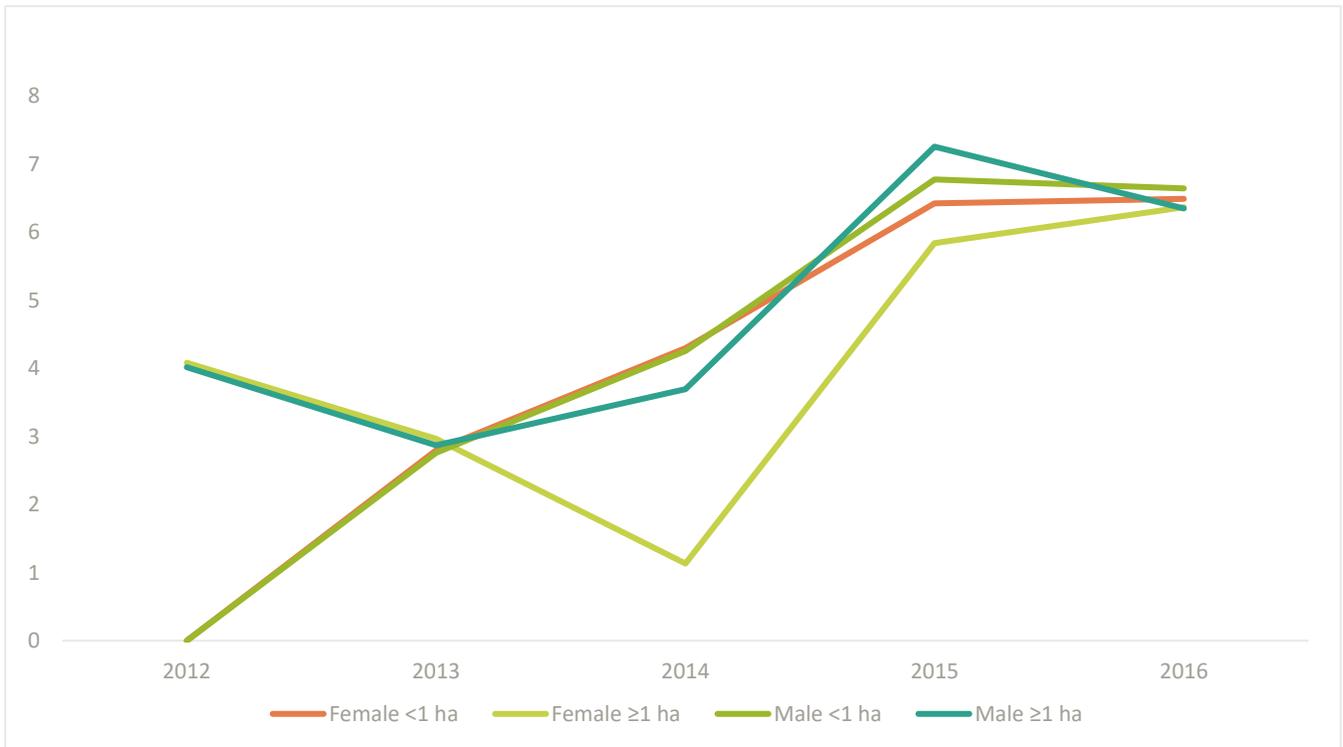
Exhibit 15. Average Yields (MT/HA) By Farmer Type, Rainfed Rice (2012-2017)



Irrigated rice yields also trend upward on average of 97 percent for all farmer types from 2012 to 2016 (see Exhibit 16, next page). No observations were recorded for women or men with less than one hectare in 2012,

putting the starting point at “zero.” This could be because the project adapted to include more youth and women by altering the type of farmer eligible for assistance from “a farmer who owned one hectare or above” to “a farmer with less than one hectare.” Men and women with less than one hectare reported a 141 and 132 percent improvement, respectively, surpassing men and women with one hectare or more at 58 and 56 percent improvement, respectively.

Exhibit 16. Average Yields (MT/HA) By Farmer Type, Irrigated Rice (2012-2016)



DISCUSSION

A. Gender and Youth Integration

During project implementation, women and youth strengthened their participation along value chains, increased their productive resources, and became more empowered and financially independent. Project data showed an increase in women having the main responsibility for their value chain over the project period. Post-project, women became even more independent, increasingly shifting to maintaining sole responsibility for their agricultural work along the value chain.

After project closure, women and youth cited increased autonomy in financial ownership and decision-making. Women said they increasingly had enough money to send their children to school and support their family to be food-secure. Respondents cited a decline in rural-to-urban youth migration as youth increasingly made a living in agriculture, sometimes by providing services along the value chain or managing a plot of land themselves. In one instance, a widow described her ability to independently manage and grow her household's assets and income using lessons she learned through MARKETS II. Therefore, while the scope of this research was limited, we do see increased integration in agricultural markets, communities, and businesses among women and youth.

B. Resilience

MARKETS II's life-of-project data and qualitative ex-post data tells the story of households' and individuals' evolving resilience to climate and economic shocks. Household food security improvements, technology adoption, income generation, increased productive resources, and market linkages were sustained one year later. Many respondents discussed their increased financial stability due to improved farming practices, crop diversification, and market linkages. Even after MARKETS II closed, individuals have maintained a stronger ability to respond to shocks, such as the flood in Kebbi in 2018. Men and women described purchasing equipment for their spouses to contribute to household income, a method to increase revenue streams and diversify in case of crop failure. Women are pooling their savings among all-female cooperatives, which can serve as informal financial assistance in times of economic duress. Men, women, and youth respondents discussed purchasing productive assets that continue to provide a return on investment, strengthening their ability to respond to intermittent shocks. Overall, household resilience increased during MARKETS II; this resilience remains one year after project closure.

C. Sustainability

Our focus-group discussions and key informant interviews demonstrated that former networked farmers continue to use agronomic practices and technologies they learned from MARKETS II. The discussions also highlighted sustained market linkages and continued knowledge dissemination through formal state channels, private sector actors, and informal farmer and community-based networks. These actors value MARKETS II-recommended practices and linkages because they make economic and business sense.

While we attribute these successes to MARKETS II, government policies have also contributed to sustained market linkages during and after the project. The government's ban on brown rice imports has allowed MARKETS II linkages to thrive and evolve after project close. The government has also recently included fertilizer on its list of items that Nigerians cannot import. This could galvanize fertilizer-producing companies to meet farmers' demands, particularly now that many farming associations, especially those networked with MARKETS II, have identified fertilizer as an important component of their financial success. If these types of policies are reversed, we may see issues maintaining MARKETS II-facilitated linkages between processors and farmers' groups if imports become more profitable than local supply.

In addition, while there may be some regional variability in each state's ability to maintain the scale of extension services supported by MARKETS II, extension agent services remain a risk to sustainability. MARKETS II supported extension services' sustainability by upgrading the skills of frontline extension agents who cooperated

with the project. Furthermore, key informant interviews revealed that farmers maintained connections with extension agents established in MARKETS II. Also, MARKETS II built links with private sources of information (including agro-dealers, buyers, and mills). These links were maintained to various degrees. According to key informant interviews with an extension agent in Kaduna and a service provider in Benue, these states do not have enough funding to maintain the extension agent levels driven by MARKETS II. In the diverse extension context of Nigeria, there is also a necessity for non-state actors to fill state gaps. One extension agent in Kebbi noted, “New programs like OXFAM, OCP Group, and NIRSAL are now working in the state, but whatever they do, they have not achieved what MARKETS II has done.” International NGOs, to some extent, take up the mantle of providing ongoing training and extension services for rural farmers. However, to ensure long-term sustainability, the state, farmer-controlled associations, and farmer-based organizations should provide and fund these services.

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