



IMPACT EVALUATION OF THE R4 RURAL RESILIENCE INITIATIVE IN SENEGAL

FINAL EVALUATION

NOVEMBER 2016

FINAL REPORT



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Acronyms and abbreviations

ANACIM	Agence Nationale de l'Aviation Civile et de la Météorologie
ANOVA	Analysis of variance
ANSD	Agence Nationale de la Statistique et de la Démographie
CNAAS	Compagnie Nationale d'Assurance Agricole du Sénégal
CSI	Coping Strategy Index
FCS	Food Consumption Score
FFA	Food for Assets
HARITA	Horn of Africa Risk Transfer for Adaptation
IFA	Insurance for Assets
IFAD	International Fund for Agricultural Development
IGA	Income-generating activity
MFI	Microfinance institution
OLS	Ordinary least squares
PADAER	Programme d'Appui au Développement Agricole et à l'Entreprenariat Rural
REST	Relief Society of Tigray
SFC	Savings for Change
SHG	Self-help group
SPSS	Statistical Package for the Social Sciences
WFP	World Food Programme

Note: exchange rates have been determined as close as possible to the transaction dates, based on www.oanda.com.

1 Executive summary

The R4 Rural Resilience Initiative is a strategic partnership between the World Food Programme (WFP) and Oxfam with the goal of responding to the challenges faced by food-insecure communities in the context of increasing frequency and intensity of climate disasters and other shocks. The program's four main risk management components include (i) risk reduction (improved resource management through asset creation), (ii) risk transfer (insurance), (iii) prudent risk taking (livelihood diversification and microcredit), and (iv) risk reserves (savings). Globally, R4 is currently operational in Ethiopia, Malawi, Senegal, and Zambia. In Senegal, the Initiative was first piloted during the 2013 agricultural season in Koussanar and has subsequently expanded to Tambacounda, Kolda, and Kaffrine regions, covering approximately 12,000 farmers. The objective of this impact assessment, which builds on a preliminary assessment undertaken in 2015, is to document lessons learned to date and provide recommendations aimed at deepening the program's impact and mitigating any negative effects.

The impact evaluation is based on household surveys of program participants and non-participants in three geographic locations: Koussanar, Tambacounda, and Kolda. For data analysis, we employ the "double difference" or "difference in difference" impact assessment method, which involves comparing the performance of both participants and non-participants across time horizons on a range of indicators and assessing the difference between changes in both groups. In Koussanar, where the program was first implemented in Senegal, we compare the performance of program participants and non-participants at three periods: March 2013 (T1), March 2015 (T2) and March 2016 (T3). In Tambacounda and Kolda, where the program began in 2014, we compare performance of participants and non-participants from March 2015 (T2) to March 2016 (T3). The household surveys undertaken in March 2016 reached a total of 1,618 households, all of which had been part of the baseline surveys undertaken in 2013 in Koussanar and 2015 in Tambacounda and Kolda. The geographic breakdown of households surveyed in 2016 is as follows:

- Tambacounda – 785 households, of which 616 are participants and 167 are non-participants;
- Koussanar – 382 households, of which 205 are participants and 177 are non-participants;
- Kolda – 451 households, of which 316 are participants and 135 are non-participants.

To further isolate the impact of the Initiative's individual components, program participants were categorized into three groups based on the interventions they received. The three sub-groups of program participants include Food for Assets (FFA); FFA + Savings for Change (SFC); and FFA + SFC + insurance.

Household crop production and food security

The survey found that both participants and non-participants reported improved staple crop production during the current year compared to the previous year, when households faced a severe drought. Despite a late onset of the rains and the several dry spells experienced in Tambacounda, the second half of the 2015-2016 agricultural season registered average or above average rainfall, driving increases in household production of staple crops. R4's interventions in developing lowland rice fields and implementing improved water management techniques under the FFA component enabled program participants to achieve higher yields compared to non-participants for rice and other staple crops, including millet, maize, beans, sorghum, and groundnut. Across all three locations (Koussanar, Kolda, and Tambacounda), the average volume of rice produced per participant household increased by 160 kg or 91.4% from 2015 to 2016, compared to 35 kg or 42.2% for non-participant households. For millet, average production per participant household increased from 348 kg in 2015 to 649 kg in 2016, an increase of 301 kg, while non-participants increased their production from 318 kg to 454 kg, an increase of 136 kg. The R4 Initiative's support for the development of vegetable gardens also enabled program participants to increase their cultivation of vegetables compared to non-

participants. The percentage of participant households that indicate that they now cultivate a vegetable garden increased by 20 percentage points, from 20% in 2015 to 40% in 2016, while that of non-participants saw an increase of six percentage points from 14% in 2015 to 20% in 2016.

Program participants also saw an increase in their Food Consumption Score (FCS) between 2015 and 2016 that was four times the increase in non-participants' FCS over the same period. Across all three locations, participants' FCS increased from 41.1 in 2015 to 49.2 in 2016, an increase of 8.1. On the other hand, non-participants' FCS increased from 34.3 in 2015 to 36.3 in 2016, an increase of 2. Driven by their increases in food production and food assistance from the program, 61% of program participants now have an acceptable FCS based on WFP's categorization, compared to 36% of non-participants. Furthermore, while both groups experienced a reduction in their Coping Strategy Index (CSI) from 2015 to 2016, the reduction was much greater for program participants (minus 7) compared to non-participants (minus 2.1). This means participants are less likely to resort to measures such as consuming cheaper but less preferable foods, borrowing food, decreasing the amount of food consumed, or buying more food on credit than usual to cope with food shortages.

Text box 1: Definitions of Food Consumption Score and Coping Strategy Index

Food Consumption Score is a proxy indicator of household food security based on the weighted frequency (number of days in a week) of intake of eight different food groups. FCS captures both quality (different food groups/dietary diversity) and quantity (food frequency) elements of food security. Households with an FCS of at least 42.5 are classified as "acceptable" while those with an FCS of between 28.5 and 42 are classified as "limited." Food Consumption Score below 28 is considered "poor".

Coping Strategy Index measures the frequency and intensity of behaviors adopted by households to cope with food shortages. Its calculation is based on the frequency a household adopts nine coping strategies over seven days and 15 other coping strategies over 30 days. Households having a higher CSI are those using coping strategies more frequently and intensively due to greater vulnerability.

Household income, assets and perception of poverty

The study found that between 2015 and 2016, program participants reported a greater increase in reliance on crop production for their household income compared to non-participants. For participants, crop production's share of total income increased from 71% to 80% between 2015 and 2016, an increase of nine percentage points, while non-participants experienced a four percentage point increase, from 69% to 73% over the period. Across all locations, average monthly expenditure by non-participants increased while it decreased for participants. The increase in expenditure for non-participants was driven by increases in food-related expenditure, indicating that non-participants were purchasing more to make up for a less productive agriculture season compared to participants.

The percentage of non-participant households that perceive themselves as very poor relative to other households within their community is higher compared to participant households. Across all three locations the percentage of participant households that identify themselves as very poor compared to other households in their community is 5.8% compared to 14.1% among non-participants.

Gender Empowerment

While formal household leadership continues to be dominated by men in both participant and non-participant households, we see evidence of increased decision-making responsibility among women in participant households. For example, women are involved in making decisions on the use of farmland in 11% of participant households compared to 6% of non-participant households. The Savings for Change component also provided an avenue for women to save and acquire small loans to engage in income-generating activities such as rice farming, peanut farming, vegetable cultivation, and small trade.

Solidarity

The increase in the percentage of heads of households who view others as generally trustworthy and helpful is higher for participants compared to non-participants, an indicator of improved community solidarity. The R4 Initiative engendered trust among participants by creating new social groups or supporting existing structures within communities, which served as the basis for improved social interactions and conflict resolution. In Kolda, for example, we found an increase of four points in the percentage of participants who perceived others as trustworthy, and a corresponding reduction in mistrust of others. On the other hand, the percentage of non-participants who perceived others as trustworthy decreased by eight points and mistrust increased by a corresponding figure. Furthermore, across all three locations, participants are more likely to turn to people within their neighborhood for support during difficult times than they were a year ago—a measure of strengthened community bonds.

Drivers of Program Performance

The literacy and gender of the head of household both play a role in driving program performance. Households with literate heads generally report a higher increase in staple crop production compared to those with illiterate heads. This translates into a higher Food Consumption Score and greater reduction in coping strategies for households headed by literates. Monthly expenditure is also higher for households with literate heads. At the same time, we find that increases in crop production are generally much higher for male-headed households. Out of the six main crops produced, four of them (rice, maize, groundnut, and millet) saw greater production increases for male-headed households. To make up for relatively lower crop production, female-headed households spend a greater proportion of their income on food, leaving a smaller proportion available for other non-food needs and household assets. Accordingly, perception of poverty is higher among female-headed households.

Benefits of Combined Interventions

Among program participants, comparison of staple crops production increases across the three intervention groups (FFA; FFA + SFC, and FFA + SFC + insurance) indicates that participants benefiting from a combination of FFA and SFC report the largest increase in the four crops produced (rice, maize, groundnut, beans). Participants that received FFA + SFC + insurance also experienced larger increases in two other crops: sorghum and millet. From this trend we can draw the general conclusion that a combination of FFA with other interventions (either SFC, insurance, or both) leads to greater increases in production for more crops. In the case of FFA + SFC, participants are able to save and receive small amounts of credit, which enables them to make effective investments in their crop production.

As expected, households with insurance spent more on average on agriculture inputs than those without insurance. It seems likely that, protected by insurance, farmers feel more confident in investing in agricultural inputs. Sustaining these investments over time should translate into higher production. Participants whose interventions included a Savings for Change component also report a lower reduction in total household expenditure between 2015 and 2016. FFA-only participants reported a reduction in average monthly expenditure by US\$35 (21,000 CFA francs) or 17.2% compared to a reduction of US\$18 (11,000 CFA francs) or 9.2% for FFA+SFC participants and US\$15 (9,000 CFA francs) or 8.3% for participants of FFA + SFC and insurance. This discrepancy suggests that the Savings for Change component bolstered household expenditure by helping households engage in revenue-generating activities such as small trade.

Lessons learned and recommendations

In summary, the program has demonstrated strong results in reducing the adverse impact of shocks on the food security of participant households. A comparison of the Food Consumption Score and Coping Strategy Index of participants and non-participants between 2013 and 2015 in Koussanar

reveals that participants coped better with the drought during the 2014-2015 agriculture season. Additionally, the decline in average monthly household non-food expenditure was higher among program participants over the same period. However, as noted earlier, the increase in savings and in the average headcount of livestock such as cattle owned by participant households relative to non-participants suggests that it is possible participants directed their investments towards savings and livestock rather than domestic household assets or other non-food household expenditure, an area that requires further research to confirm. Also, the program has strengthened social bonds among program participants, as demonstrated by the more favorable evolution in perceptions of trust and helpfulness among program participants compared to non-participants.

We provide the following recommendations to strengthen the program's impact:

- a. Recommendations on further assessments of the effects of investments by participant households:
 - *Undertake in 2017 a follow-up study of indicators of income, assets, and investments in order to assess the impact of savings, investments in revenue-generating activities and increased cattle ownership.* Additionally, the study should analyze the factors that influence households' expenditure and investment decisions, including which assets they consider important in strengthening their own resilience.
- b. Recommendations to deepen the program's impact in protecting household agriculture production, consumption, and nutrition against shocks:
 - *Provide targeted support to households headed by illiterates and women to minimize the effect of shocks on their food security and to speed up their recovery.* The program can consider introducing a literacy component to help illiterate participants to acquire basic skills that will enable them to better benefit from the program's activities. For female-headed households, in addition to helping women to cultivate vegetables and rice, the program can add to its mandate working with local institutions toward removing barriers that women face in agriculture production.
 - *Expand support for rice and vegetable production to address other stresses that inhibit productivity to further protect households' food security against shocks.* Areas that require further support include developing fences on all vegetable gardens to protect them from destruction by freely grazing livestock, providing agricultural equipment, and ensuring that inputs such as seeds and fertilizer are delivered to farmers in a timely manner in the agriculture season.
- c. Recommendations to improve program performance in increasing household income, assets, and investments in normal times:
 - *Expand and deepen support for households undertaking income-generating activities that can help place them on a stronger income trajectory post shocks.* Beginning with agriculture, which is the main economic activity of households, the program can support in the following ways: organizing and supporting collective selling, training farmers on quality management and marketing, linking farmers/farmer groups to top-of-supply-chain buyers, linking participants with market information systems, and expanding the number of participants covered by revolving credit schemes to undertake income-generating activities.
 - *More fully integrate the program's various components in order to leverage the respective strengths of each component toward increasing resilience before, during, and after shocks.* For example, the SFC methodology, including savings and credit, bolstered household expenditure by helping households to engage in revenue-generating activities such as small trade, while FFA is also essential to bolstering the food security of households. The

three interventions should continue to be offered as an integrated package to support participants in a holistic manner.

- *Increase awareness of the benefits of insurance for securing households' productive investments, minimizing the impact of shocks, and strengthening the ability of households to rebound.* Increased awareness of how insurance works as well as prompt payments of payouts will increase the confidence of farmers in the product and encourage even greater agricultural investments. This, in turn, can lead to increased crop production to meet the nutritional and income needs of households.

2 Context, objectives, and methodology

2.1 Context and introduction to R4

For the 1.3 billion people living on less than a dollar a day who depend on agriculture for their livelihoods, vulnerability to climate-related shocks is a constant threat to food security and well-being. As climate change drives an increase in the frequency and intensity of natural hazards, food-insecure communities struggling to improve their lives and livelihoods face increasing challenges. The question of how to build rural resilience against climate-related risk is critical for addressing global poverty.¹

In Senegal, climate-related and other shocks pose a significant threat to the food security and livelihoods of smallholder farmers, as highlighted by the recent drought in 2011/2012, as well as the six major droughts the country experienced between 1977 and 2002. Heavy reliance on rain-fed agriculture amplifies the challenges climate-related shocks pose for the livelihoods of many. Current population and agriculture trends could lead to a 30 percent reduction in per capita cereal production by 2025.²

To address these challenges, the World Food Programme (WFP) and Oxfam have partnered to launch the R4 Rural Resilience Initiative with a goal of responding to the challenges faced by food-insecure communities in the context of increasing frequency and intensity of climate disasters and other shocks. The Food Security Information Network's Multi-agency Technical Working Group on Resilience Measurement, within which the WFP has played a leading role, defines resilience as "the capacity to ensure that shocks and stressors do not have long-lasting adverse development consequences." This definition encompasses elements found in other definitions of resilience, such as the set of capacities required before, during, and after the onset of shocks and stressors that provide the ability to:

- **Absorb:** resist a shock or the eroding effects of a stressor by reducing risk and buffering its impact, which leads to endurance and continuity of livelihoods and systems;
- **Adapt:** respond to change by making proactive and informed choices, leading to incremental improvements in managing risks; and
- **Transform:** change the set of available choices through empowerment, improved governance, and an enabling environment, leading to positive changes in systems, structures, and livelihoods.³

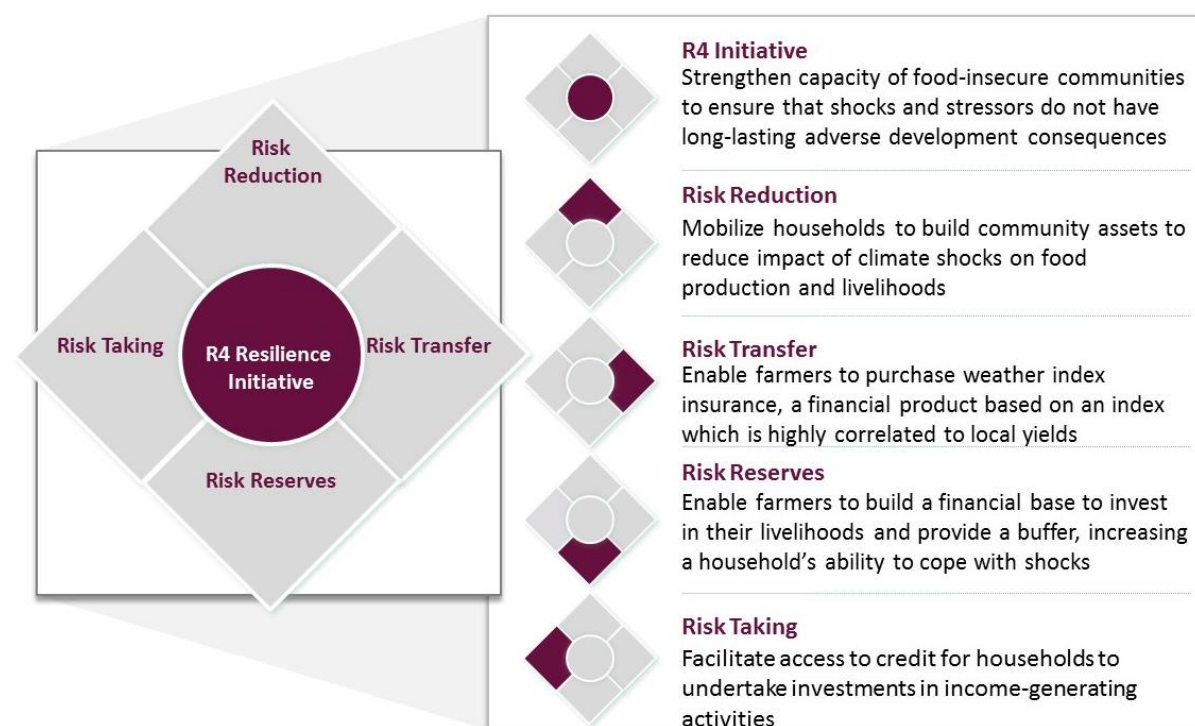
Launched in 2011, the R4 Initiative builds on the initial success of Horn of Africa Risk Transfer for Adaptation (HARITA), an integrated risk management framework developed in Ethiopia by Oxfam, the Relief Society of Tigray (REST), Ethiopian farmers, and several other national and global partners. R4 refers to a combination of four risk management actions: (i) risk reduction (improved resource management through asset creation), (ii) risk transfer (insurance), (iii) prudent risk taking (livelihood diversification and microcredit), and (iv) risk reserves (savings). Globally, R4 is currently operational in Ethiopia, Senegal, Malawi, and Zambia. The diagram below describes the Initiative's four main dimensions.

¹ WFP, Oxfam, R4 Rural Resilience Initiative, Partnerships for Resilient Livelihoods in a Changing Climate

² Famine Early Warning Systems Networks, "A Climate Trend Analysis of Senegal," October 2012.

³ WFP, "Draft Policy on Building Resilience for Food Security and Nutrition," April 2015.

Figure 1: Four main dimensions of the R4 program



2.2 Description of R4 activities in Senegal

a. Description of R4 regions of focus

In Senegal, R4 operates in Tambacounda, Kaffrine, and Kolda, regions that are characterized by the presence of food-insecure farmers and high reliance on rain-fed, subsistence agriculture. With a combined population of over two million people—representing 14.3%⁴ of the Senegalese population—and a vast rural population that practices agriculture, the regions of Tambacounda, Kolda, and Kaffrine are among the country's most vulnerable regions to climate shocks. For example, in Tambacounda, 76.3% of the population lives in rural areas and 70.9% of households practice subsistence agriculture as their main economic activity. Similarly, for Kolda, 74.4% of the population lives in rural areas and 75.3% of households engage in agriculture for their livelihoods. In Kaffrine, 84.8% of the population lives in rural areas and 87.6% of the working population practices agriculture as its main activity.⁵

High poverty rates in these three regions, well above the national average poverty rate for Senegal, also amplify the adverse impact of these populations' exposure to shocks. In Kolda, Tambacounda, and Kaffrine, the poverty rate is estimated at 76.6%, 64.5%, and 63.8%, respectively, against a national average of 46.7%. Households within these regions spend a disproportionately large share of their income on food consumption: 64% in Tambacounda and 59% in Kolda, while the national average is 46%.⁶

b. Description of R4 program rollout in Senegal

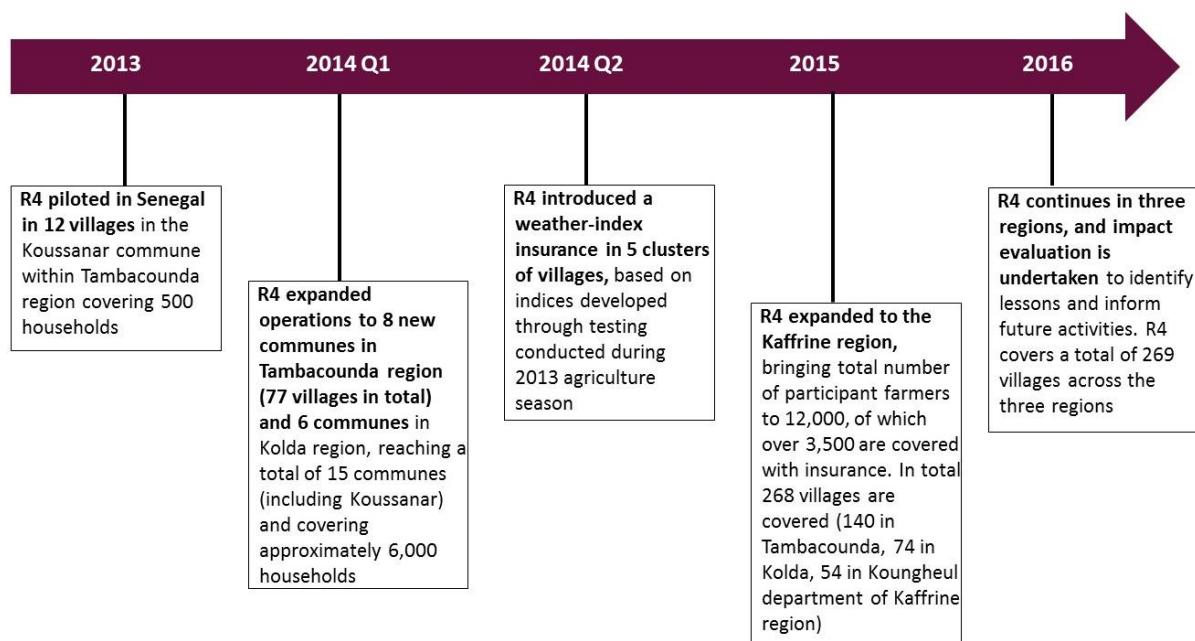
⁴ Agence Nationale de la Statistique et de la Démographie (ANSD), "Projection de la Population du Sénégal," July 2015.

⁵ United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), "Aperçu des Besoins Humanitaires - Senegal," November 2013.

⁶ United Nations Children's Emergency Fund (UNICEF), "Rapport mensuel sur la situation humanitaire - Sénégal," September 2013.

R4's engagement in Senegal began in 2012 with an assessment of the context and a mapping of potential areas and participants. During the 2013 agricultural season, WFP and Oxfam piloted R4 in 500 households in 12 villages within the *commune* of Koussanar, in Tambacounda region. In 2014, R4 Senegal expanded its operations to eight new communes in Tambacounda region and to six communes in Kolda region, reaching a total of 15 communes (including Koussanar), covering approximately 6,000 households, and offering weather-index insurance in five clusters of villages.⁷ In 2015, R4 expanded to Kaffrine region, bringing the total number of farmers covered through the program to approximately 12,000, of which over 3,620 received insurance coverage.

Figure 2: Timeline of R4 rollout in Senegal



The key activities undertaken in Senegal under the four risk management components of R4 include:

- **Risk transfer:** Through CNAAS (National Agricultural Insurance Company of Senegal), R4 offers a weather-index insurance product to individual farmers, delivering it through savings associations. Up to three individuals in a household can purchase the product, which protects against rainfall shortages during two critical crop-growing periods. Smallholder farmers pay the premiums and receive insurance through the Insurance for Assets (IFA) scheme (working on risk reduction assets in exchange of insurance cover).
- **Risk reduction:** R4 mobilizes members of the community to build community assets including the rehabilitation of low-lying lands for rain-fed rice cultivation, the creation and maintenance of nurseries for vetiver plants, compost pit making, the construction of dikes and stone barriers, the construction of dams and the creation of vegetable gardens. In return for their efforts in building community assets that are protecting their communities against the effects of climate variability, participants receive a transfer (in the form of food or food coupons through WFP's traditional Food for Assets (FFA) mechanism)⁸, and insurance coverage through

⁷ Clusters typically include a group of villages surrounding the same *bas-fond* with a pre-determined distance from a central village used by the index insurance designer as a reference.

⁸ Program website accessed at: <https://www.wfp.org/food-assets>

the IFA scheme, by working for additional days. Beginning in 2016, under this component, the initiative also provides climate services.

- **Risk reserves:** This component is based on Oxfam's Savings for Change (SFC) program. Members organize into savings groups that save regular amounts of money every week, which is kept by the group's treasurer. Members are allowed to borrow at a given interest rate to cover sudden expenditures in the household and have to return the money within a short time span (one to three months).
- **Prudent risk taking:**
 - *Cereal banks:* Since 2009, WFP has been setting up cereal banks in some villages. Stocks collected by the members are supposed to be sold to villagers at 'moderate' prices during the lean season and the money generated used to buy new stocks at harvest.
 - *Revolving credit fund:* In 2015, the project created a revolving credit fund in partnership with a microfinance institution (MFI) that provides credit to mature savings groups (organized around associations of common economic interests) to enable members to engage in income-generating activities.
 - *Warrantage:* In 2014, the R4 Initiative piloted an inventory credit system whereby the stock in the cereal bank can be used by farmers as collateral to obtain credit from local MFIs.

2.3 Overview and objectives of the evaluation

From the beginning of the R4 Initiative's rollout in Senegal, monitoring and evaluation has constituted an important dimension of the program's activities, with the objective of gaining insights that can help shape the program's development. Accordingly, following the program's pilot in Koussanar, the initiative conducted an initial survey in March 2013 (T1) to collect baseline data from program participants and non-participants in Koussanar, covering a total of 399 households. A second data collection in March 2015 (T2) reached 376 households belonging to the sample surveyed in T1 (March 2013), as well as an additional 19 households. Comparing the baseline data collected in March 2013 (T1) and the second survey of March 2015 (T2) enabled the program to conduct a preliminary assessment of its impact in Koussanar, published in 2015. This assessment was conducted by Dalberg Global Development Advisors (Dalberg).

In addition to the preliminary impact assessment for Koussanar, Dalberg collected baseline data in Tambacounda and Kolda following the expansion of the R4 program to these regions. The survey in Tambacounda and Kolda included groups of both participants and non-participants. Additionally, in order to allow for an assessment of the impact of different combinations of R4 components, researchers identified and surveyed sub-groups of participants. These sub-groups included participants of FFA only, FFA + SFC, and FFA + SFC + insurance. Eight hundred households were surveyed in Tambacounda region in March 2015, including 200 FFA participants, 200 FFA + SFC participants, 200 FFA + SFC + insurance participants, and 200 non-participants. In Kolda region, the 2015 household survey included 600 households: 200 FFA participants, 200 FFA + SFC participants, and 200 non-participants.⁹

The final phase of the program's impact evaluation process commenced with a third round of data collection in March 2016 (T3), covering Kolda, Koussanar, and Tambacounda. This impact assessment report contains Dalberg's analysis of these data. The objectives of this final impact assessment are to:

⁹ Insurance was not offered in Kolda until 2016.

- document lessons learned to date that can be utilized as the program continues, scales up, and is transferred to other countries;
- provide recommendations for the way forward in Senegal, particularly in relation to enhancing the positive impacts of the program as well as mitigating any negative impacts that have occurred or are likely to occur.

2.4 Methodology

During this final phase of the impact evaluation, data collection teams surveyed the same households surveyed in the baseline studies, following the sampling methodology described above. A total of 20 interviewers and four supervisors undertook data collection, using tablet computers and smartphones running on the CSEntry application, embedded with controls.

The interviewers surveyed a total of 1,618 households across all three locations, broken down as follows:

- In Tambacounda, 785 households were surveyed, of which 157 received FFA, 203 received FFA + SFC, 258 received FFA + SFC + insurance, and 167 were non-participants.
- In Koussanar, 382 households were surveyed, of which 33 received FFA, 35 received FFA + SFC, 137 received FFA + SFC + insurance, and 177 were non-participants.
- In Kolda, 451 households were surveyed, of which 129 received FFA, 187 received FFA + SFC, and 135 were non-participants. Insurance was introduced in Kolda only in 2015, hence the survey did not include a sub-group engaged in insurance.

Figure 3: Locations covered by the R4 impact evaluation survey



Whenever possible, we selected households to interview in Tambacounda and Kolda based on the spatial representativeness of the village. If, for example, eight households were to be interviewed in a village, the supervisor divided the village into two zones (albeit notionally) to let surveyors conduct four interviews in each zone. The surveyor then identified a starting point from which he / she would select the first household. From the starting point, the first household was selected by applying the

“code of the day.”¹⁰ After identifying the first household on the basis of this approach, the selection of the following households was conducted by applying a fixed sampling interval. In Senegal, the sampling interval usually applied to household surveys in rural areas is three. For example, after the first household, the interviewer skips two doors and enters the third house. In the event that a household is in a group of several households, the choice of the house was based on the Kish grid.¹¹

In addition to the household survey, the research team conducted focus group discussions with groups of program participants in order to obtain qualitative information on the Initiative’s impact. Across the three target locations, we conducted a total of 48 focus group discussions in 16 clusters (with three focus groups per cluster). Focus group discussions were organized as groups of women, men, and mixed groups, representing both program participants and non-participants.

We relied on the “double difference” or “difference in difference” impact assessment method for our data analysis. This method involved comparing performance of both participants and non-participants across time horizons on a range of indicators and assessing the difference between changes in both groups. For example, quantitative variables such as the food consumption score of households were analyzed through a comparison of the change in participants’ values and the change in non-participants’ values between the periods T1 (March 2013) and T3 (March 2016) for Koussanar and T2 (March 2015) and T3 (March 2016) for Tambacounda and Kolda. The method of double difference cancels the influence of unobservable characteristics, thereby enabling us to isolate the effect that can be linked to the intervention. The method of double difference constitutes acceptance of ordinary least squares (OLS) model assumptions. Another key assumption for the double difference method is that of parallel trends—i.e., we assume that, had the intervention not taken place, the dependent variables would exhibit the same tendencies for participants and non-participants alike.

A limitation encountered during the data collection phase of the study was the change in the number of households in various sub-groups (i.e., FFA, FFA + SFC, FFA + SFC + insurance) between the 2015 and 2016 samples in Tambacounda and Kolda. For example, of the 391 households surveyed in 2015 that belonged to the FFA sub-group, only 281 stayed within that same group in 2016, while the rest joined other intervention groups. Additionally, out of the 385 households surveyed in 2015 that belonged to the FFA + SFC subgroup, 335 stayed within that same group and 50 joined other groups. To ensure the accuracy of comparison between groups, the analysis for the evaluation took into account only households that have not changed groups since the collection of the baseline data. As a result, we were left with reduced sample sizes for analysis on the impact of the program on various sub-groups of participants. However, these sample sizes remained sufficient for statistical comparisons and analysis.

The use of electronic tools for data collection limited the risk of missing values. However, in cases of missing values, we used mean imputation sub-group, median, or modal value, depending on the type of missing value. Data analysis is based on two-dimensional analysis using comparative tests (tests comparing averages, chi-square tests, ANOVA, etc.) with the STATA statistical software and the Statistical Package for the Social Sciences (SPSS).

In this report, the household is defined as a social unit composed of individuals with family relationships or other social relations who take their meals together and share a common resource base. In the same vein, the head of household is the person who coordinates the activities of

¹⁰ The “code of the day” is obtained by adding the digits of a date until a single digit. For example, for the dates January 2, January 16, January 19 and January 29, the respective codes are: 2, 7, 1, and 2.

¹¹ The Kish grid or the Kish selection table is a method for selecting members to interview within a household. The interviewer consults a predefined table of random numbers in order to find the person to be interviewed. The statistician Leslie Kish developed the grid in 1949; today it is a widely used research survey technique.

production and resource use. It is not necessarily the eldest of the household and is not necessarily a man. Other members of the household are within the budgetary authority of the household head, at least in theory.

3 Summary of key findings from R4 interim impact evaluation

a. Key findings from interim impact evaluation

The interim R4 impact evaluation report prepared in June 2015 compared performance between participants and non-participants in Koussanar between 2013 and 2015. The evaluation revealed a general trend of decline in food production and consumption in the region, linked to poor rainfall, as the region of Tambacounda (within which Koussanar is located) recorded a lower rainfall (523.4 mm as at September 2014 vs. 783.1 mm as at September 2013).¹² Participants, however, demonstrated stronger resilience compared to non-participants and coped better with these constraints. For example, while variables related to food production and consumption, such as the Food Consumption Score (FCS), decreased between 2013 and 2015 for both participants and non-participants, the program helped participants limit these reductions compared to non-participants. In the case of FCS, non-participants saw a reduction of 49.1% compared to 8.1% for participants. Additionally, the percentage of participants whose FCS score was classified as acceptable, based on WFP's categorization, remained steady at around 76% between 2013 and 2015 while that of non-participants declined from 75% to 13%. Additionally, an analysis of the Coping Strategy Index (CSI) indicated that while both participants and non-participants increased their use of coping strategies to mitigate or solve food security challenges, this increase was higher for the non-participants because they faced higher levels of food insecurity.

The evaluation also revealed that the financial education and support for savings groups organized through the Initiative's SFC methodology helped participant households to engage in more income-generating activities. As such, unlike the non-participant population, participants were able to maintain their level of wealth. This is reflected in the estimated expenses for participant households compared to non-participants: in 2015, participants spent¹³ US\$ 56 (33,600 CFA francs) on average per month (2,800 CFA francs per capita) for food products while non-participants consumed on average US\$ 40 (25,200 CFA francs) per month in food products (2,200 CFA francs per capita).

Focus group discussions and stakeholder interviews also highlighted several additional changes attributable to the program's interventions within communities. Solidarity increased within intervention villages, catalyzed by the community activities organized by the program under the FFA component and the savings groups under the SFC methodology. However, despite increases in organizational capabilities and feelings of group solidarity, resilience at the community level remained weak due to lack of effective mechanisms to generate group responses to unexpected shocks. Although the R4 Initiative supports communities in developing economic potential and environmental adaptability, another key component of community resilience remains to be addressed: organizational capacity to produce unified community responses to major shocks.

b. Key questions emerging from these initial findings

Building on the insights obtained from the interim evaluation, this final phase evaluation seeks to deepen the analysis on the program's impact across a wider geographic area and explore questions that emerged from the interim assessment. Specific areas of analysis to deepen include the following:

- *Impact on gender empowerment:* A focus of this evaluation is to assess the gender dimensions of the R4 program with the objectives of understanding i) the effect the program is having on

¹² Comité National AGRHYMET du Sénégal, Bulletin Agrométéorologique Décadaire, Septembre 2014.

¹³ The estimated expenditure includes the consumption both cash and in-kind (including the on-farm consumption).

expanding the range of economic opportunities available to women and ii) women's influence in shaping economic decisions.

- *Impact on climate shock adaptation:* To assess the program's capacity to support households facing climate shocks, we compare the performance of both participant and non-participant households exposed to these shocks on a number of indicators relating to food security.
- *Analysis of effect of characteristics of household head on performance:* To generate additional insights on drivers of outcomes, we compare performance between households (across a number of indicators) based on the literacy and gender of the household head.
- *Analysis of impact of program components:* Based on the sub-groups of participants surveyed in Tambacounda and Kolda, we compare results between participants of FFA only, FFA + SFC, and FFA + SFC + insurance. We did not include in the analysis a separate sub-group of FFA + insurance as most participants in the insurance program also participated in SFC—indicating that such a group will be largely similar to the FFA + SFC + insurance sub-group.

4 Overview of program impact across the three geographic locations

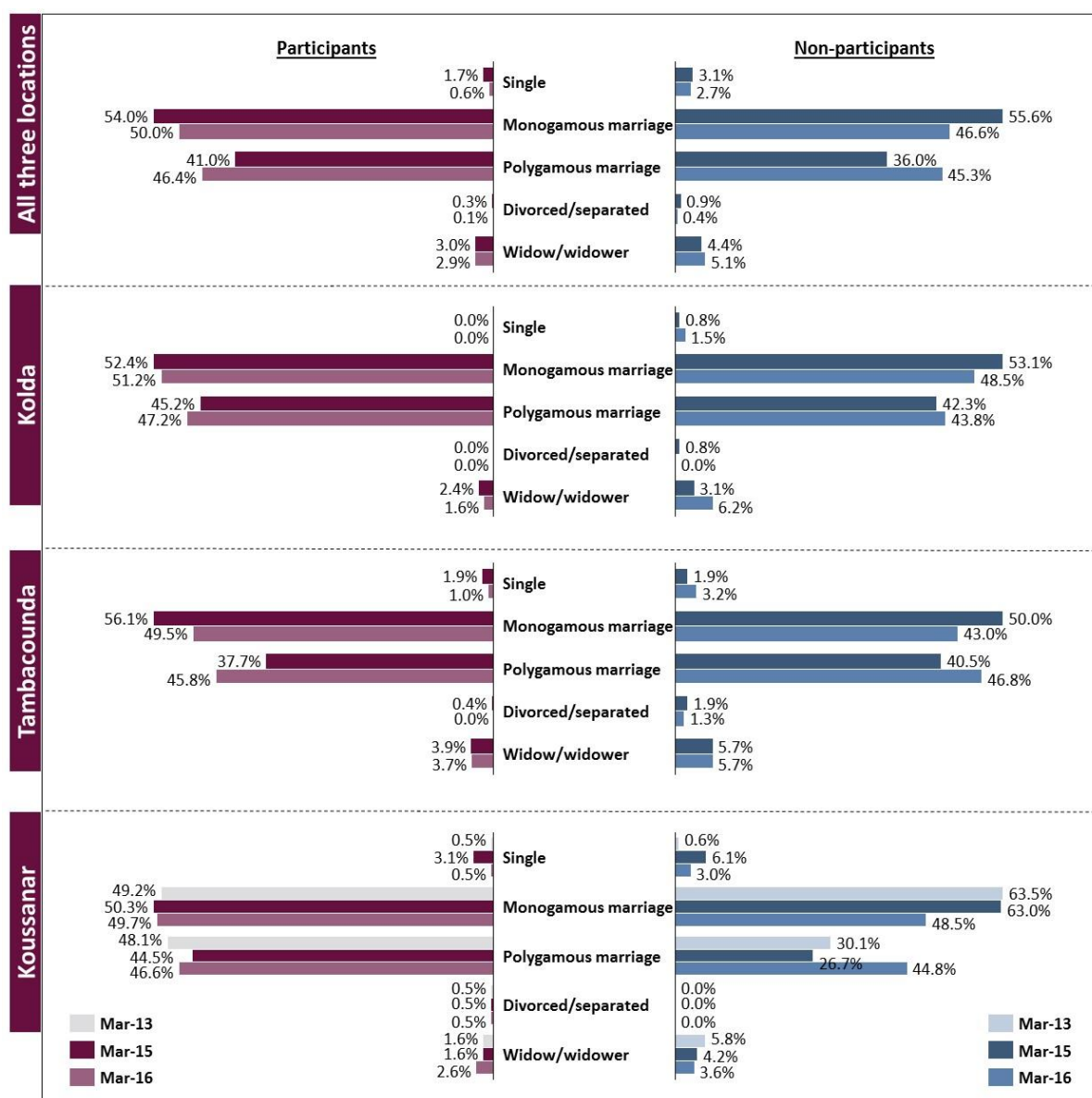
4.1 Overall characteristics of participant and non-participant households

This sub-section presents the evolution of households' characteristics between 2013 and 2016 for Koussanar, and 2015 and 2016 for Tambacounda and Kolda. Analyses of households' characteristics show few changes during the period, and only minor differences between participants and non-participants. On the marital status of the household head, we observe an increase in polygamous unions among household heads, in both participant and non-participants, across all three locations. The majority of household heads still cite agriculture production as their main economic activity. Further, while the majority of households, both participants and non-participants, still rely on outdoor wells for water, participants report a greater increase in access to outdoor and indoor taps compared to non-participants. Participants also report a slightly larger increase in access to electricity and solar panels.

a. Heads of household

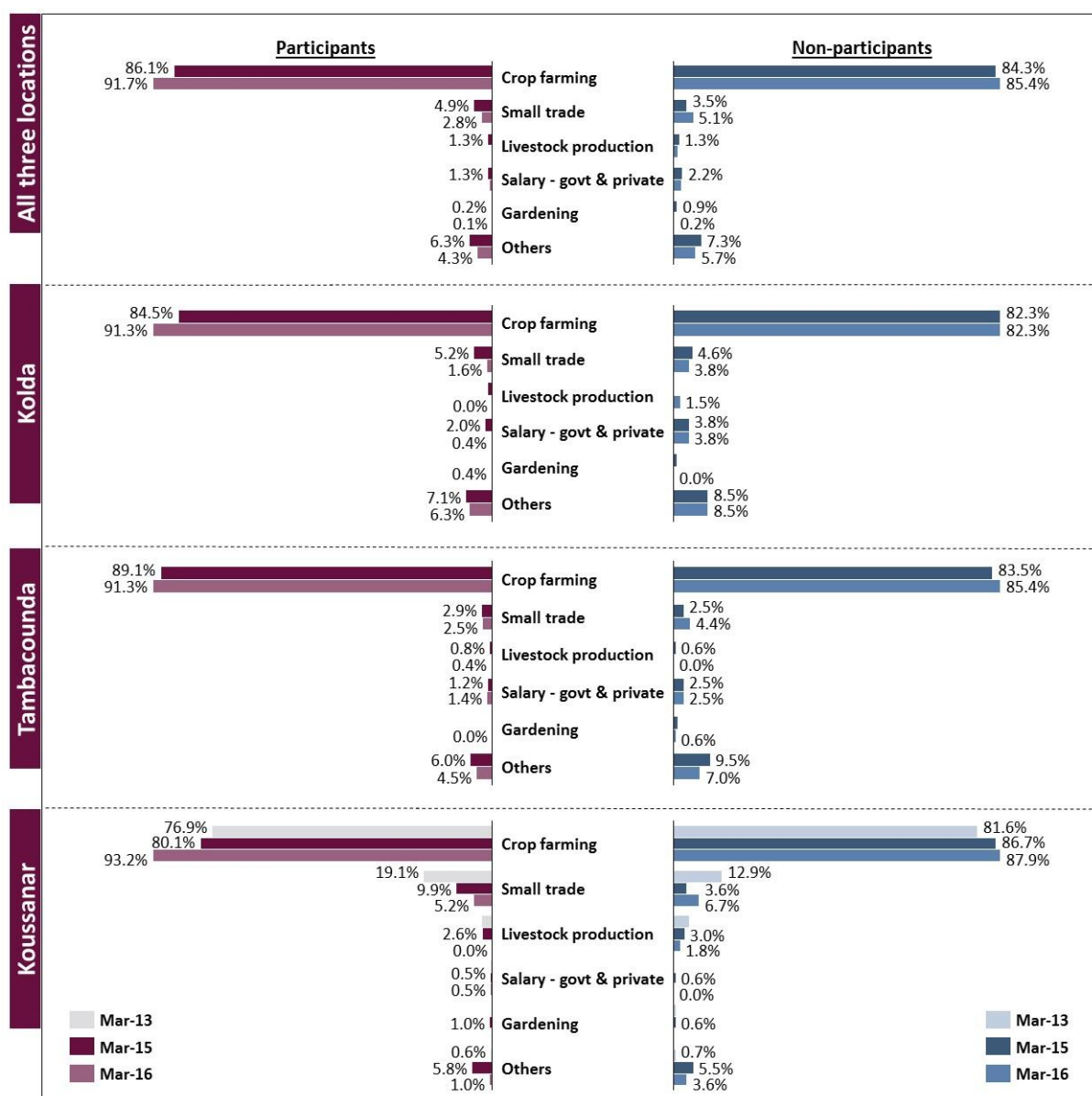
Summary: Across all three locations, the percentage of household heads in polygamous marriages increased for both participants and non-participants, with a corresponding drop in household heads in monogamous marriages. Between 2015 and 2016, the percentage of household heads in polygamous marriages increased from 41% to 46% for participants and 36% to 45% for non-participants. While this trend was observed in all three locations, the increase in polygamous marriages among both participants and non-participants is, however, larger in Tambacounda compared to Kolda. In Koussanar, in 2016, we notice a reversal of the general decline in polygamous marriages that was witnessed between 2013 and 2015. However, the increase was steeper among non-participants (from 27% in 2015 to 45% in 2016) compared to participants (from 45% in 2015 to 47% in 2016).

Figure 4: Marital status of household head, %



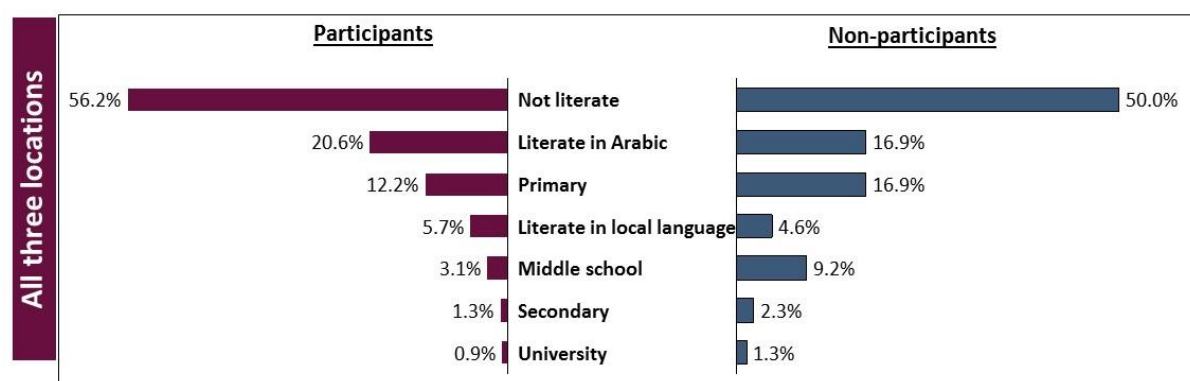
Across all three locations the percentage of household heads whose primary occupation is crop production increased for both participant and non-participant households, with participant households reporting a greater increase. Roughly 92% of household heads among participants and 85% of household heads among non-participants indicate that crop farming is their primary occupation. Larger increases in agriculture output for participants (explained in section 4.2) may account for their higher dependence on agriculture as their primary source of livelihood compared to non-participants. While crop farming is the primary occupation of most household heads, households surveyed also undertake other activities to sustain their livelihoods, such as small trade and livestock production. For example, 14.9% of participant households cite small business as one of the family's sources of income in 2016 compared to 10.2% among non-participants.

Figure 5: Main economic activity of household head, %



The majority of household heads are illiterate in both participant and non-participant households. Across all three locations, the illiteracy rate among participants is 56.2% compared to 50% among non-participants.

Figure 6: Level of literacy of household head, %



Additional description of the general household characteristics of communities for this survey is available in the appendix.

4.2 Food security, nutrition and coping strategies

Summary: The survey found that both participants and non-participants report improved food production and consumption compared to last year. However, program participants reported much larger improvements compared to non-participants. For all three locations, program participants saw larger increases in production of rice and other staple crops—including millet, maize, and sorghum—as well as beans and groundnut. A higher number of program participants also indicate that they cultivate a vegetable garden. Additionally, the increase in the Food Consumption Score (FCS) is more than three times higher for participants compared to non-participants, indicating that participants have made stronger progress in improving their food security. Driven by their increases in food production and food assistance from the program, 61% of participants now have an acceptable FCS, compared to 36% of non-participants. At the same time, program participants experienced a reduction in the Coping Strategy Index (CSI) of minus 7 compared to a minus 2.1 reduction among non-participants.

a. Agriculture and livestock production

i. Production of rice and other staple crops

Despite a late onset of the rains and the several dry spells experienced in Tambacounda, the second half of the 2015-2016 agriculture season registered average or above average rainfall, driving increases in household production of staple crops, with participants experiencing greater increases. In Kolda, rainfall data from the Agence Nationale de l'Aviation Civile et de la Météorologie (ANACIM) indicate that as at October 2015, the region had recorded a cumulative rainfall of 1,215.6 mm in 2015 compared to yearly average of 1,022 mm over the period 1981-2010. Additionally, Tambacounda recorded a cumulative rainfall of 662.7 mm as at October 2015 compared to 620.9 mm in 2014¹⁴ and a yearly average of 702.2 mm over the period 1981-2010.¹⁵ The percentage of households that indicated that they were exposed to climate shocks is also lower for the 2015-2016 agriculture season compared to the 2014-2015 season (described in section 4.5).

¹⁴ SODEFITEX, Suivi de la Campagne Agricole 2014/2015 AU 15 Octobre 2014. Accessed at <http://sodefitex.sn/index.php/fr/actualites/dernieres-infos/15-actualites/268-suivi-de-la-campagne-agricole-2014-2015-au-15-octobre-2014>

¹⁵ Data accessed at: <http://www.anacim.sn/oldsite/IMG/pdf/-185.pdf>

Text box 2: R4 support for lowlands rice production

The R4 Initiative supported households in increasing their rice production by aiding the development of lowlands rice fields, providing input support, and training participants on improved water management techniques. For example, in Kolda region, the program developed a total of 117 hectares of lowlands for rice cultivation in 2015 by mobilizing and equipping communities to work in fields in return for payment through food vouchers and insurance coverage. In developing the lands for rice cultivation, emphasis was placed on ensuring that effective water conservation techniques are implemented in the fields. Accordingly, in Kolda, the program supported the development of 1,650 meters of stone bunds around lowland rice farms to control water levels in 2015. In Tambacounda, in 2015, the project developed 14,310 meters of stone bunds in sites previously developed by the project and an additional 5,140 meters of stone bunds in new sites developed in 2015. Furthermore, the project supported the development of 15,063 meters of small dikes in Kolda region and 19,500 meters in Tambacounda region on lowland rice farms. Additionally, the input support component of the program provided participants with certified seeds and fertilizer. For example, the program provided a total of 5,760 kg of certified rice seeds to participants in the Kolda region in 2015.

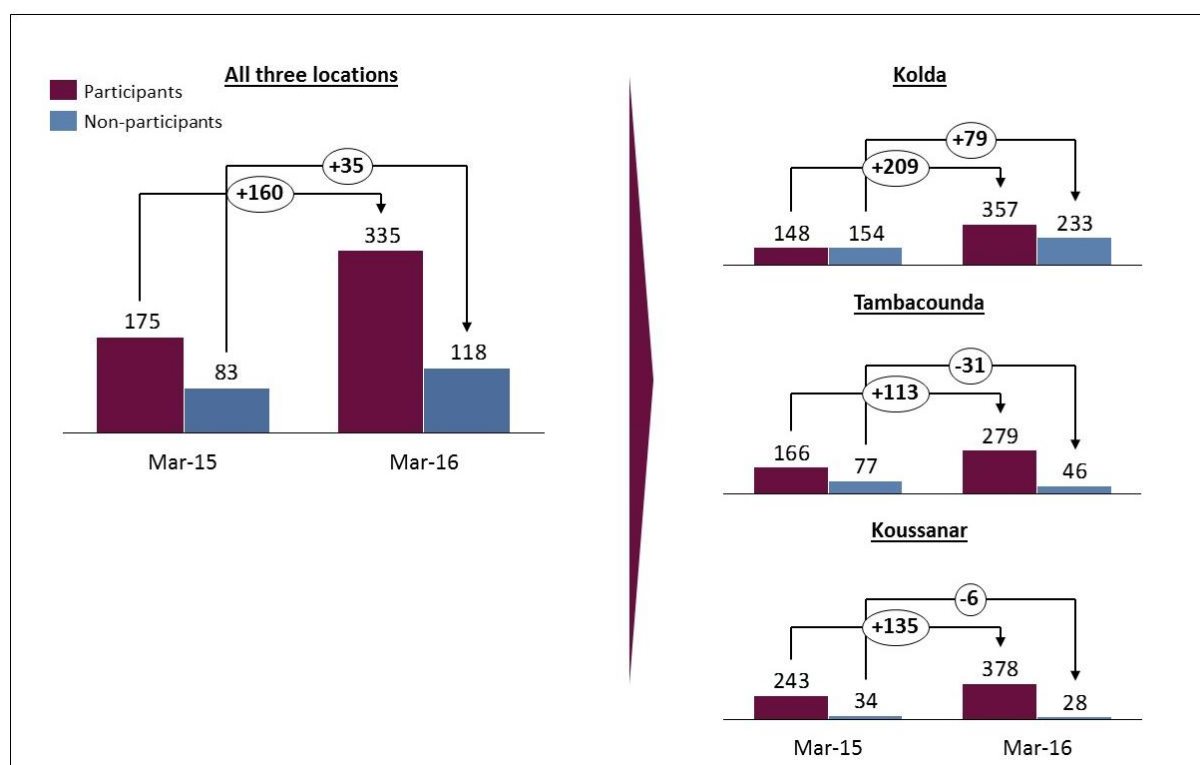


In Senegal's Tambacounda region, farmers face a growing risk of droughts and floods as familiar rain patterns change. Building stone bunds protects rice fields from silting and improves production. These assets are built under the risk reduction component of the R4 Rural Resilience Initiative. Farmers are also using affordable crop insurance to increase their resilience and food security.

Photo credit: Carla De Gregorio, March 2015

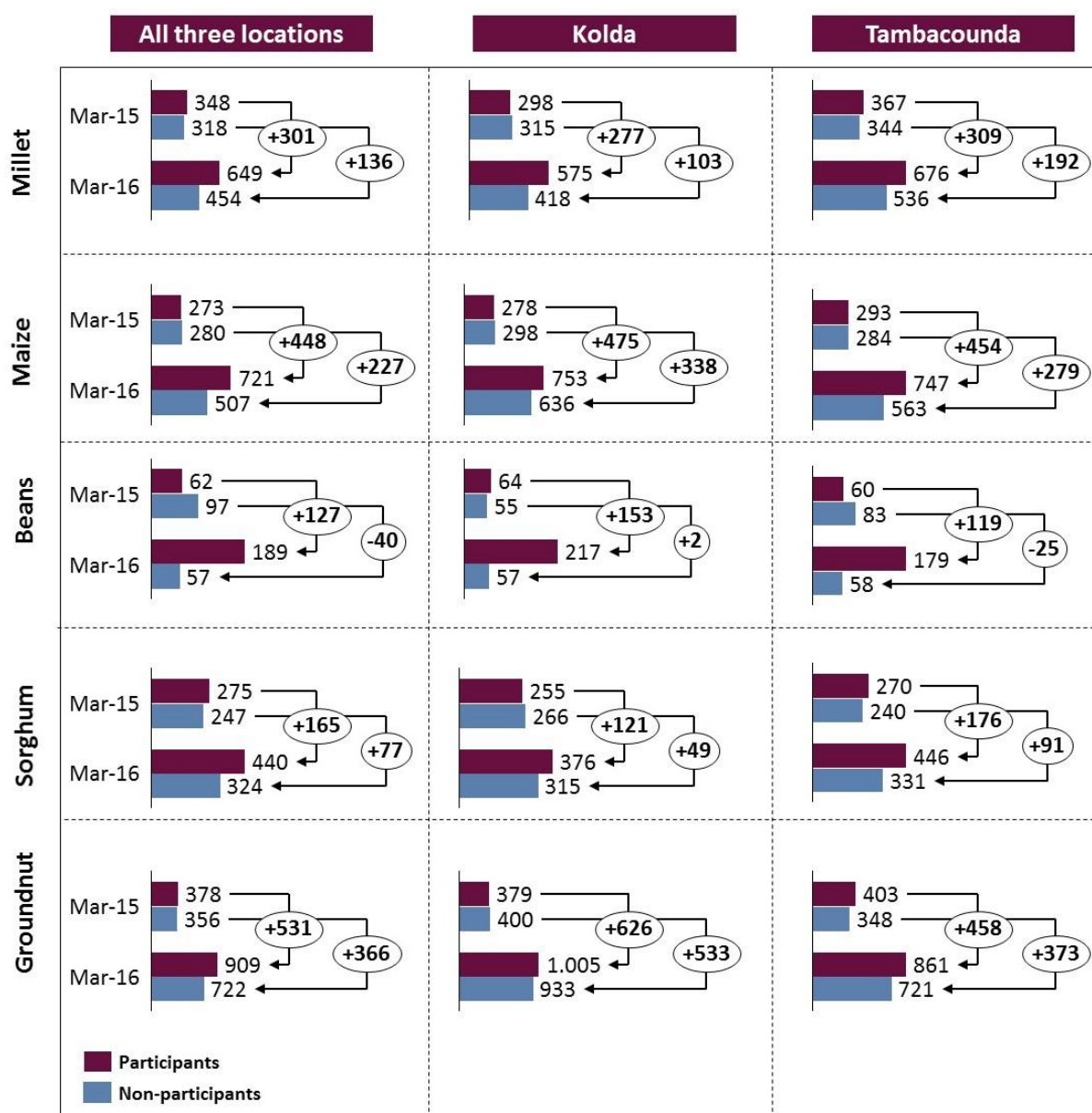
Data from household surveys confirm that as a result of the support received from the program, participants recorded a larger increase in the production of rice compared to non-participants between 2015 and 2016. Across all three locations, the average volume of rice produced per participant household increased by 160 kg or 91.4% from 2015 to 2016, compared to 35 kg or 42.4% for non-participant households. In Kolda region, program participants increased their average household production of rice by 209 kg, from 148 kg in 2015 to 357 kg in 2016, while non-participants recorded a smaller increase of 79 kg, from 154 kg in 2015 to 233 kg in 2016. In Tambacounda, program participants recorded an increase in average household production of rice of 113 kg, from 166 kg in 2015 to 279 kg in 2016 while non-participants recorded a decline in production of 31 kg, from 77 kg in 2015 to 46 kg in 2016. In Koussanar, program participants recorded an increase in average volume of household production of rice of 135 kg, from 243 kg in 2015 to 378 kg in 2016 while non-participants recorded a decline of 6 kg, from 34 kg in 2015 to 28 kg in 2016.

Figure 7: Average household production of rice, kilograms



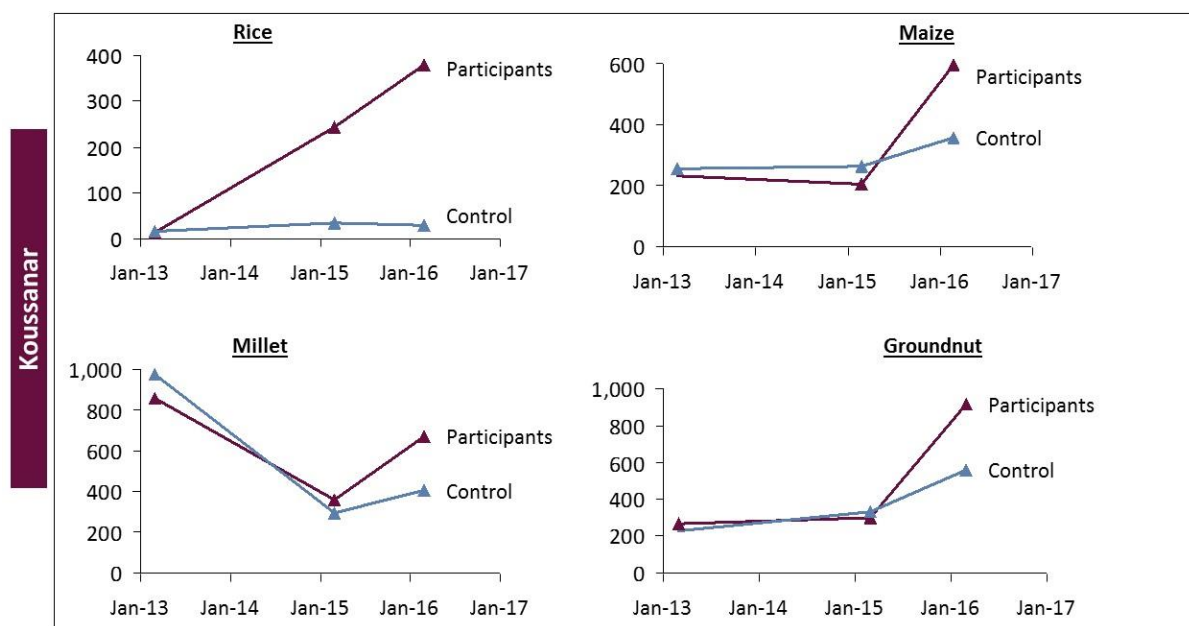
Beyond rice, program participants also saw larger increases in the production of other staples, including beans, millet, maize, sorghum, and groundnut, as a result of greater use of inputs and the implementation of better production techniques made possible through the program's support. Program participants increased their bean production on average by 127 kg per household between 2015 and 2016 while non-participants witnessed a decline of 40 kg per household over the period. Average millet production per participant household increased from 348 kg in 2015 to 649 kg in 2016, an increase of 301 kg, while non-participants increased production from 318 kg to 454 kg, an increase of 136 kg. For groundnuts, participants increased their production by 531 kg per household compared to an increase of 365 kg per non-participant household.

Figure 8: Average household production volume of staple crops, kilograms



In Koussanar, staple crop production trends between 2013 and 2016 confirm that participants experienced higher increases in yields compared to non-participants. As Figure 9 demonstrates, between 2013 and 2015, program participants experienced an average of 229 kg increase in rice production per household while non-participants experienced a 19 kg increase over the same period. Furthermore, from 2015 to 2016, program participants increased their rice production by 135 kg per household while non-participants experienced a decline of 6 kg per household. In the case of maize, between 2013 and 2016 participants experienced an increase in average household production of 366 kg while non-participants saw an increase of 98 kg.

Figure 9: Average household production of staple crops in Koussanar from 2013 to 2016, kilograms



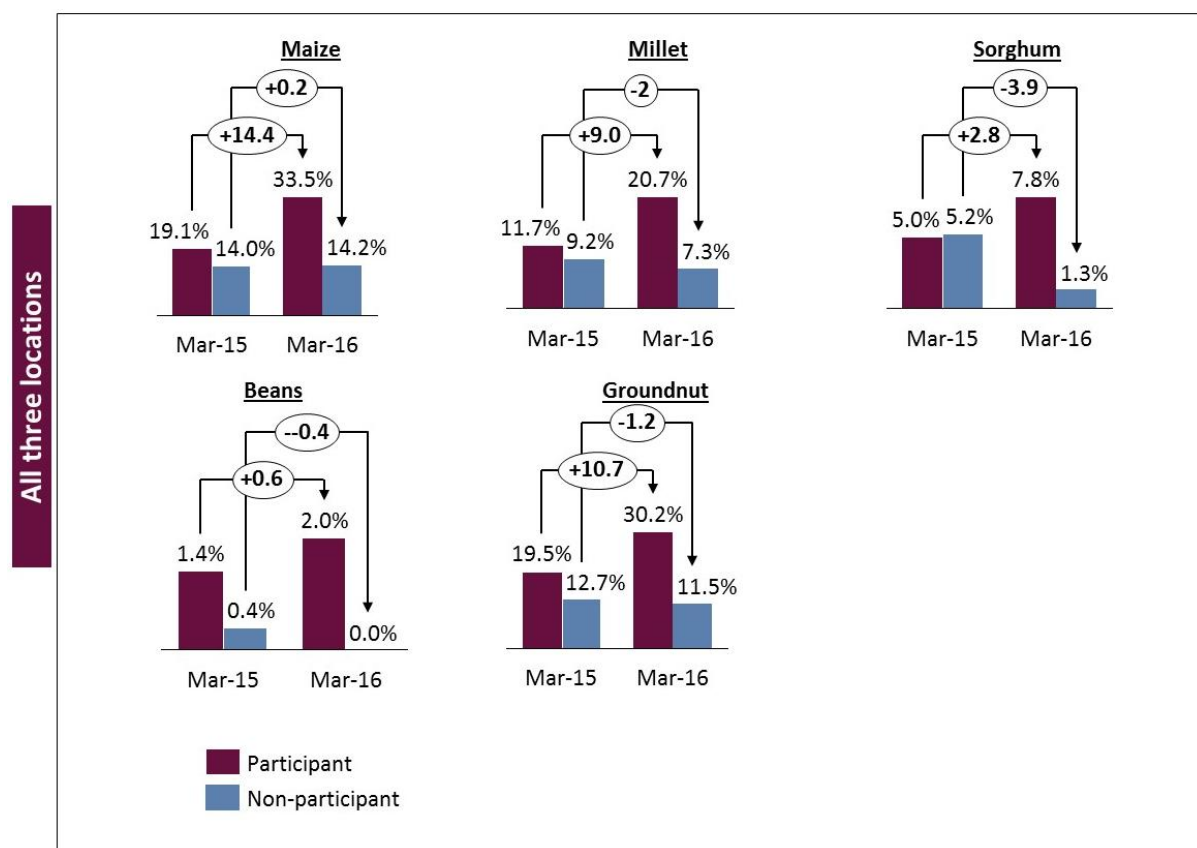
During focus group discussions, program participants indicated that training in compost pit making as well as the credit from savings groups enabled them to increase their use of fertilizer (both organic and non-organic) compared to non-participants. Across all three locations, there was a 14 percentage point increase between 2015 and 2016 in the number of participants who indicated they applied fertilizer on maize, while the number of non-participants saw no increase over the same period. For millet, the percentage of participating households that indicated they applied fertilizer increased by nine percentage points between 2015 and 2016, compared with a decline of two percentage points among non-participating households. The trends were similar for sorghum, groundnut, and beans. The growth in fertilizer use among participants was made possible by the program's training on compost pit making and provision of small credit through the savings groups, which allowed participants to make productive investments.

"The program provided training on how to prepare compost. Now I'm able to produce my own organic fertilizer for vegetables and other crops."



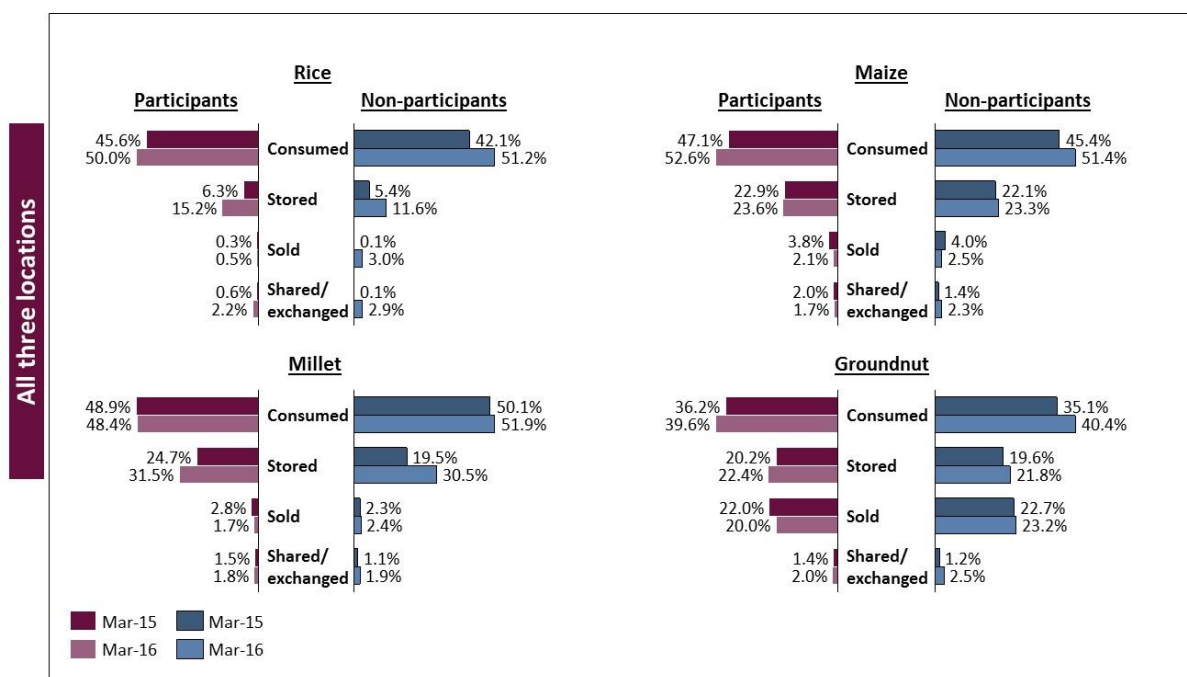
Program participant in Medina Eljadji, Kolda

Figure 10: Percentage of households that apply fertilizer (both organic and non-organic) to crops, %



Despite the increases in production of staple crops, between 2015 and 2016, participants and non-participants alike still consumed or kept in stock the majority of produce; with the exception of the groundnut, the percentage of produce sold did not significantly change. For most products, the percentage of output consumed increased among both participants and non-participants; the portion of the harvest sold either diminished or increased marginally. The results show that with the exception of groundnuts, commercialization of staple crops remains limited, with households producing to feed their families or keep in store for future use. Qualitative insights obtained from the focus groups and project implementation partners confirm that households have traditionally focused on subsistence agriculture. Households cite the low farm gate prices as well as the refusal of buyers to pay promptly when crops are offered on credit as factors that discourage them from selling. Additionally, households that do not produce enough surpluses after taking into account their consumption do not sell. For rice, the percentage of total output that is consumed increased from 45.6% in 2015 to 50% in 2016 for participants and from 42.1% in 2015 to 51.2% in 2016 for non-participants. The percentage of rice output that is stored also increased from 6.3% in 2015 to 15.2% in 2016 for participants and from 5.4% in 2015 to 11.6% in 2016 for non-participants. Meanwhile the proportion of rice output that is sold increased marginally from 0.3% in 2015 to 0.5% in 2016 for participants and 0.1% in 2015 to 3% in 2016 for non-participants.

Figure 11: Utilization of staple crops produced, %



ii. Production of vegetables

Text box 3: R4 support for vegetable production

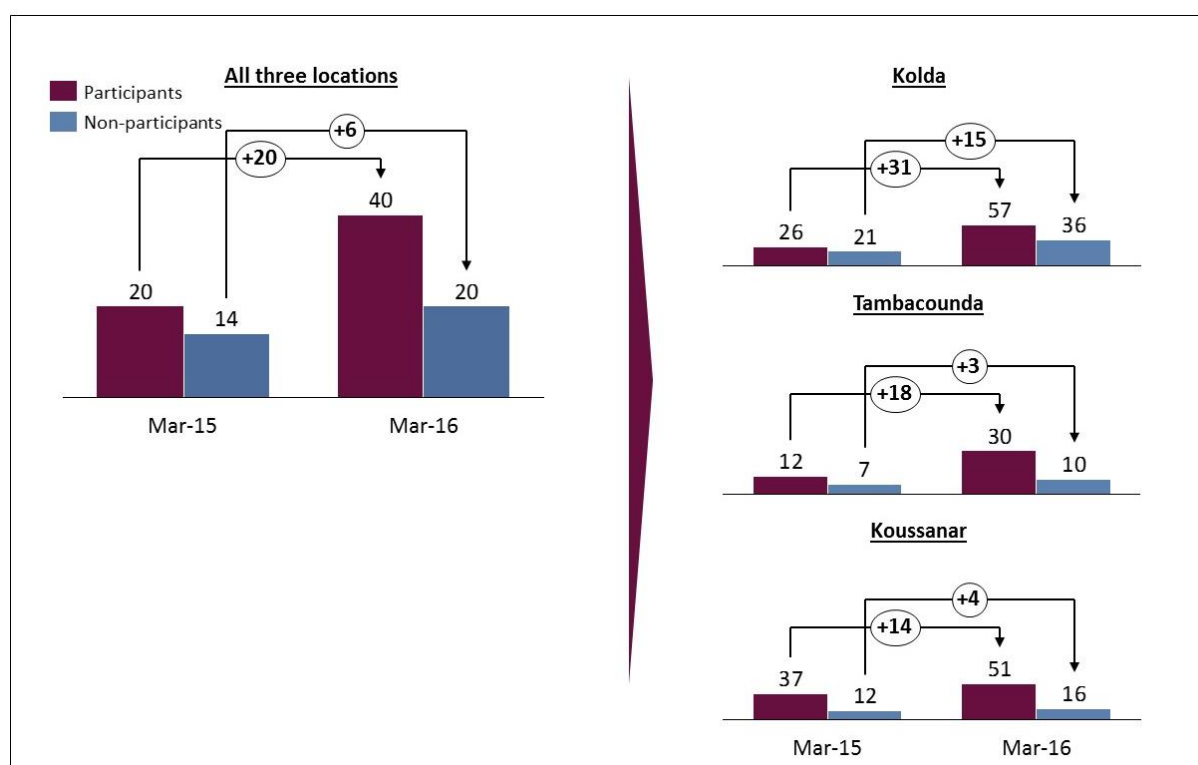
The R4 program supported rural households' efforts to increase cultivation of vegetables for their own consumption and as an income-generating activity to further strengthen their resilience to shocks. Targeting primarily women (for example, based on available program data, 85% of participants in vegetable garden cultivation in Kolda were women), this component of the program mobilized, trained, and equipped participants with seeds to develop vegetable gardens. In Kolda, the project assisted with the development of a total of 14 hectares of land in 2015, covering 10 sites and benefiting 19 villages. In addition to supporting with land preparation, the project helped participants develop fences to protect crops from destruction by livestock and assisted with the development of wells in certain sites to irrigate the crops. Project implementation partners offered training to participants on techniques for soil preparation and fertilization, direct seeding and transplanting, standards on spacing between rows and between plants, effective watering regimes, and crop protection, including weed and disease control. Vegetables supported by the program include onion, pepper, tomato, and okra.



R4 participants in the village, Missira Kamangang in Kolda region, tending to their vegetables in a fenced vegetable garden supported by R4.

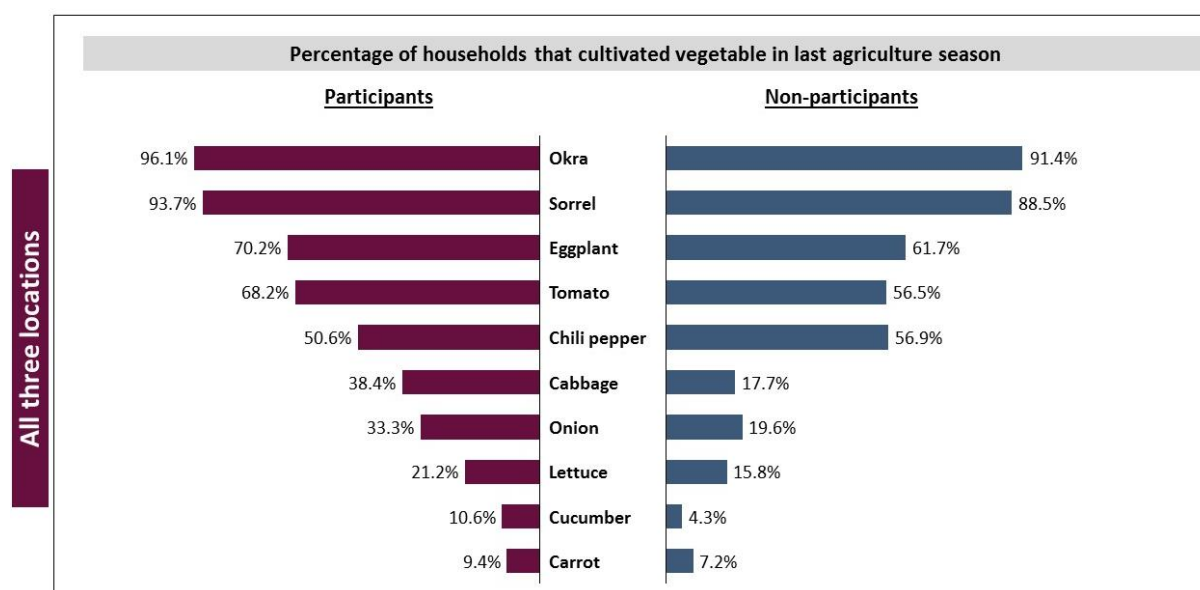
Data from household surveys confirm that a greater proportion of participants indicate that they cultivate a vegetable garden compared to non-participants. Across all three locations, while the percentage of participant households that indicate that they now cultivate a garden increased by 20 percentage points, from 20% in 2015 to 40% in 2016, that of non-participants saw a six-percentage-point increase from 14% in 2015 to 20% in 2016. In Kolda region, the percentage of participants who now cultivate a garden increased by 31 percentage points, from 26% in 2015 to 57% in 2016, while that of non-participants increased by 15 points, from 21% in 2015 to 36% in 2016. In Tambacounda, participants experienced an 18-percentage-point increase from 2015 to 2016 in the proportion of households that cultivate a garden, as opposed to a three-percentage-point increase among non-participants. Similarly, in Koussanar, participants indicated a 14-percentage-point increase in garden cultivation over the same time period as opposed to an increase of 4 percentage points among non-participants.

Figure 12: Percentage of households that now cultivate a vegetable garden



Additionally, the percentage of households that indicated that they cultivated key vegetables in the last agriculture season is higher for program participants compared to non-participants. As shown in Figure 13, a higher percentage of program participants indicated that they cultivated okra, sorrel, eggplant, tomato, chili, cabbage, onion, lettuce, cucumber, and carrot. The lack of baseline data for this indicator means a comparison from 2015 to 2016 is not possible.

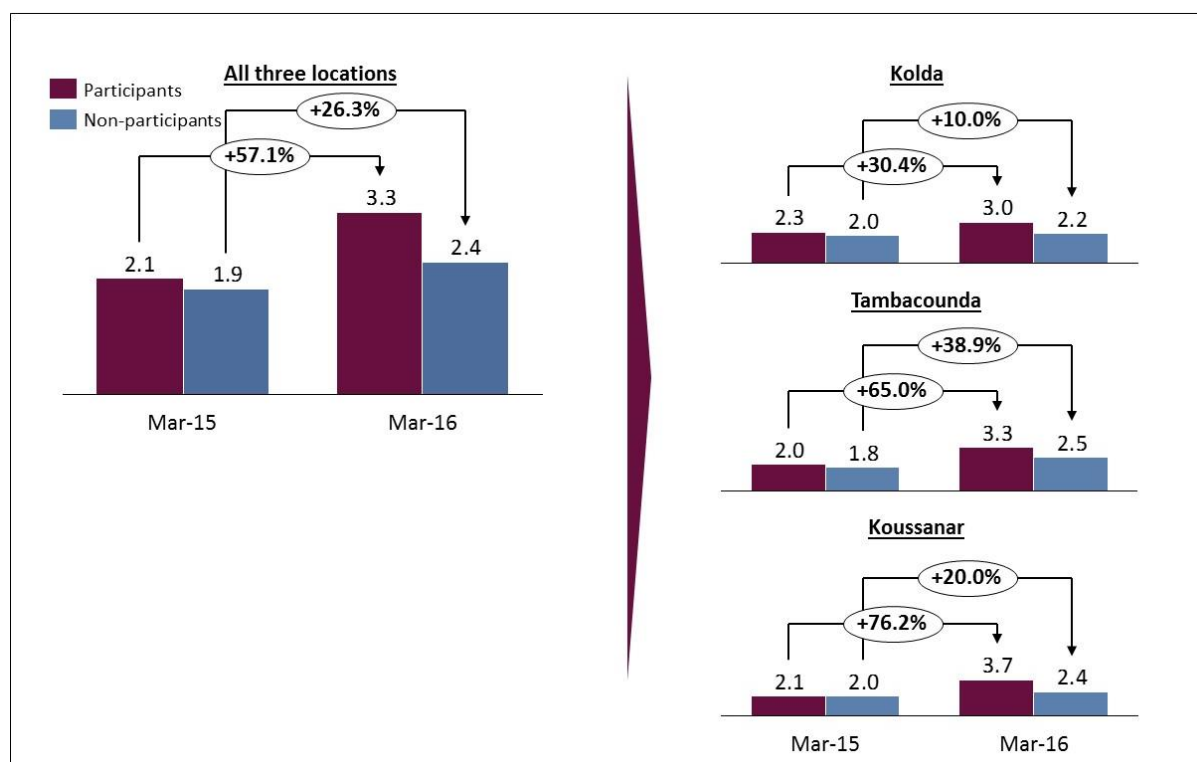
Figure 13: Percentage of households that cultivated key vegetables in last agriculture season



As a result of their increased cultivation of vegetable gardens, program participants report a greater increase in consumption of vegetables, a vital component for good nutrition. Across all three

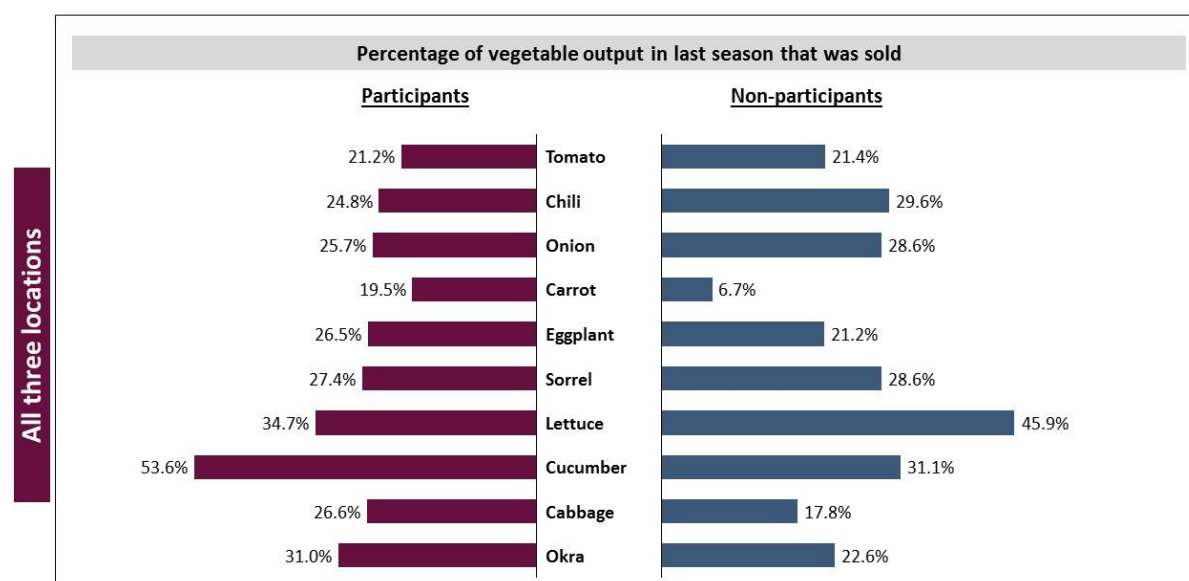
locations, the frequency of consumption of vegetables among participants increased by 57% from 2015 to 2016 while that of non-participants increased by 26% over the same period. In Kolda, participants increased their frequency of consumption of vegetables by 30% from 2015 to 2016 while non-participants increased theirs by 10% over the same period. In Tambacounda, participants increased the frequency of their consumption of vegetables by 65% from 2015 to 2016 while non-participants increased theirs by 39% over the same period. Finally, in Koussanar, participants increased their vegetable consumption by 76% between 2015 and 2016 while non-participants increased theirs by 20%. The increased consumption of vegetables among participant households also contributed to their overall higher Food Consumption Score (discussed in section B below) compared to non-participants.

Figure 14: Average number of days within a week that households consume vegetables



In addition to improving households' nutrition, vegetable production also provided an important source of income for households. Both participant and non-participant households sold a significant portion of their total vegetable production over the past season, as illustrated in Figure 15. Participant households sold a higher proportion of their seasonal production of carrot, eggplant, cucumber, cabbage, and okra, while non-participants sold a higher proportion of their production of tomato, chili, onion, sorrel, and lettuce. The lack of baseline data for this indicator means a comparison from 2015 to 2016 is not possible.

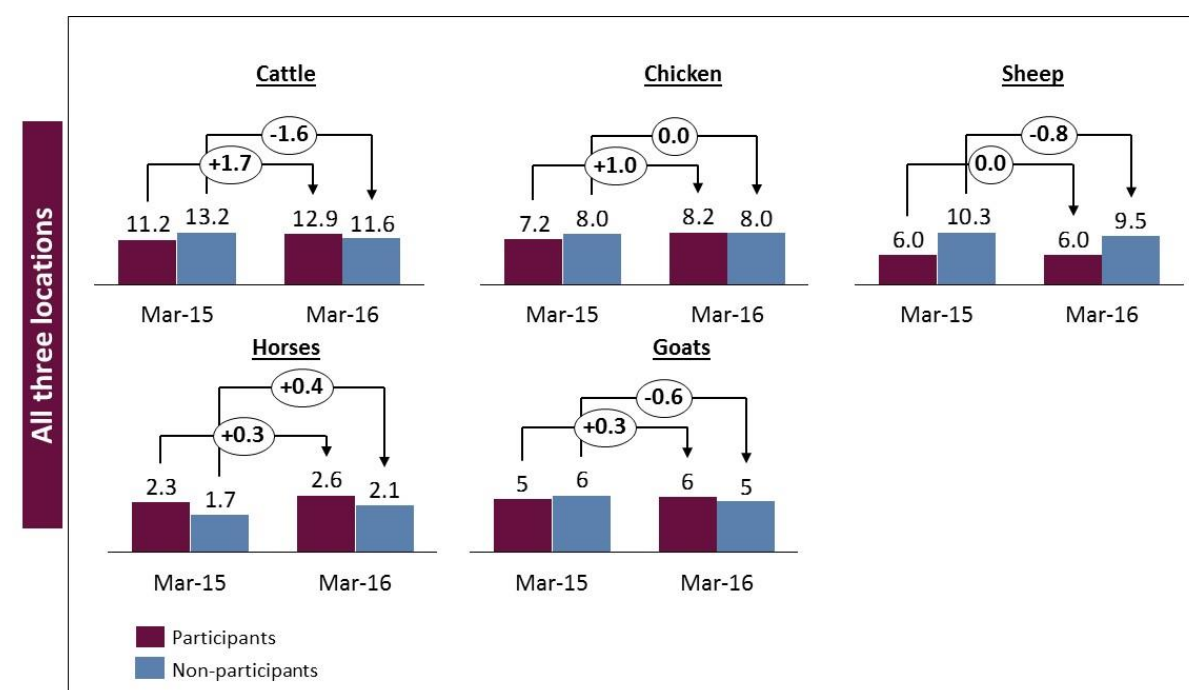
Figure 15: Percentage of vegetables produced that is sold



iii. Livestock production

Mirroring crop production, participants saw a greater increase in their livestock production compared to non-participants. For non-participants, we see a decrease in the average head count of cattle (-1.6), sheep (-0.8), and goats (-0.6), and stagnant production for chicken. On the other hand, for program participants, we see an increase across all animals: (+1.7) for cattle, (+1) for chicken, and (+0.3) for goats and horses. While the program did not have a component that directly focused on supporting livestock production, the availability of credit for participants through the saving groups as well as higher production of crops that can be used to feed livestock contributed to a better performance on livestock production for participants.

Figure 16: Livestock production trends

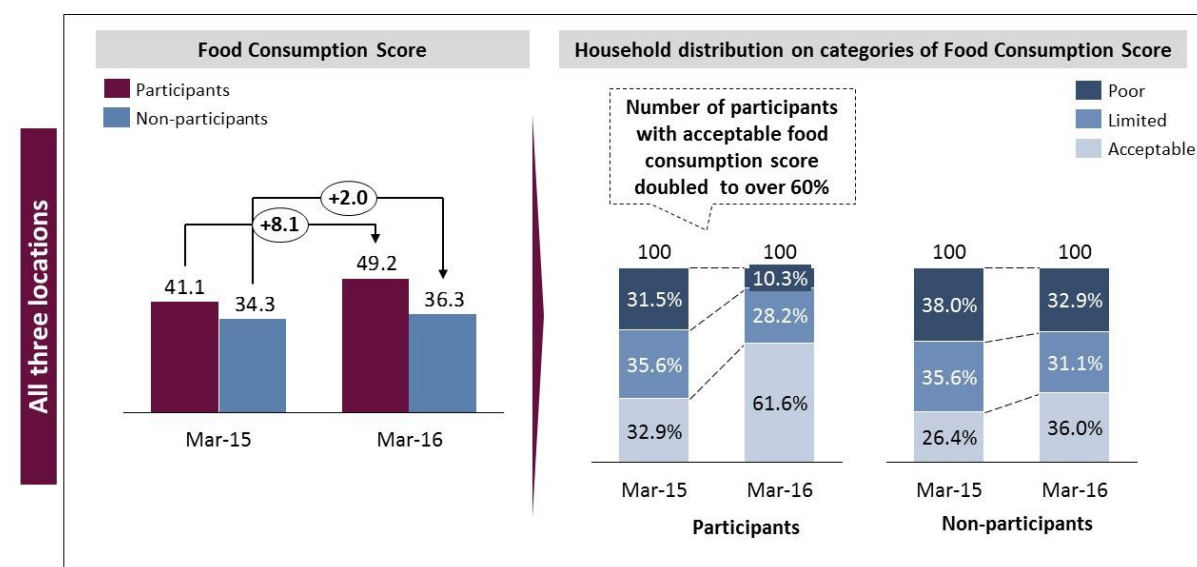


b. Food Consumption Score

Both program participants and non-participants witnessed an increase in their Food Consumption Score (FCS), but the increase was more than three times higher for participants compared to non-participants. The increase in the FCS of both groups is linked to a more favorable agriculture season in 2015-2016 compared to 2014-2015, leading to improved levels of crop production. However, participants—in addition to experiencing larger increases in production of rice and other staples compared to non-participants—also diversified into vegetable production and received food assistance from WFP under the FFA component of the R4 program. This enabled participants to experience a greater increase in their FCS compared to non-participants. Across all three locations, participants' FCS increased from 41.1 in 2015 to 49.2 in 2016, an increase of 8.1. On the other hand, non-participants' FCS increased from 34.3 in 2015 to 36.3 in 2016, an increase of 2.0. This indicates that participants consumed a more diverse range of food products at higher levels of frequency compared to non-participants. Food categories that are considered in calculating the FCS include cereals and tubers, pulses, vegetables, fruits, meat and fish, milk, sugar, and oils.

Additionally, the percentage of participant households with an FCS that is acceptable according to WFP thresholds doubled from 32.9% in 2015 to 61.6% in 2016, while non-participants experienced a much smaller increase from 26.4% in 2015 to 36% in 2016. Households with an FCS of at least 42.5 are classified as “acceptable” while those with an FCS of between 28.5 and 42 are “limited.” Households with an FCS below 28 are classified as “poor.” Between 2015 and 2016, the percentage of participant households with a poor FCS classification shrank from 31.5% to 10.3% while non-participants observed a relatively limited reduction from 38% to 32.9%. The R4 program has directly enabled households to improve their food consumption and nutritional needs.

Figure 17: Change in Food Consumption Score and household distribution on categories of Food Consumption Score



A comparison between the three locations covered by the evaluation indicates that participants in

“Microfinance and savings for income generating activities, increases in food donations through vouchers to face the lean season, and increases in our own production capacity are rolling back hunger.”

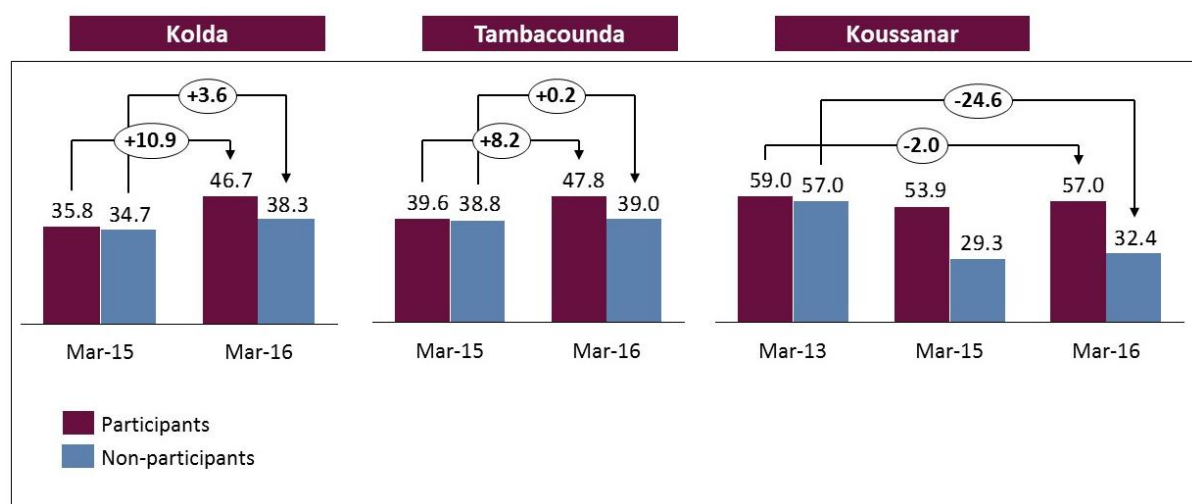


Farmer in Medina Elhadji,
Kolda

all three locations report a greater increase in their FCS compared to non-participants. In Kolda, participants report a 10.9 increase in FCS (from 35.8 in 2015 to 46.7 in 2016) compared to a 3.6 increase (from 34.7 in 2015 to 38.3 in 2016) for non-participants. In Tambacounda,

participants' FCS increased by 8.2 (from 39.6 in 2015 to 47.8 in 2016) compared to an increase of 0.2 (from 38.8 in 2015 to 39 in 2016) for non-participants. In Koussanar, between 2013 and 2015, both participants and non-participants recorded a drop in the FCS scores, with non-participants observing a larger reduction of 27.7 (from 57 in 2013 to 29.3 in 2015) compared to 5.1 reduction among participants (from 59 in 2013 to 53.9 in 2015). The relatively slight reduction in FCS that participants recorded compared to non-participants between 2013 and 2015 during a relatively unfavorable agriculture season underscores the program's strength in increasing resilience among households, helping them cope with shocks to food security. However, between 2015 and 2016, both groups reported an increase in their FCS by 3.1. For participants, their FCS increased from 53.9 in 2015 to 57 in 2016 and for non-participants it increased from 29.3 in 2015 to 32.4 in 2016. A comparison between the period 2013 and 2016 indicates that participants have fared much better over the entire period, witnessing a drop of FCS of 2 (from 59 in 2013 to 57 in 2016) while non-participants witnessed a drop of 24.6 (from 57 in 2013 to 32.4 in 2016).

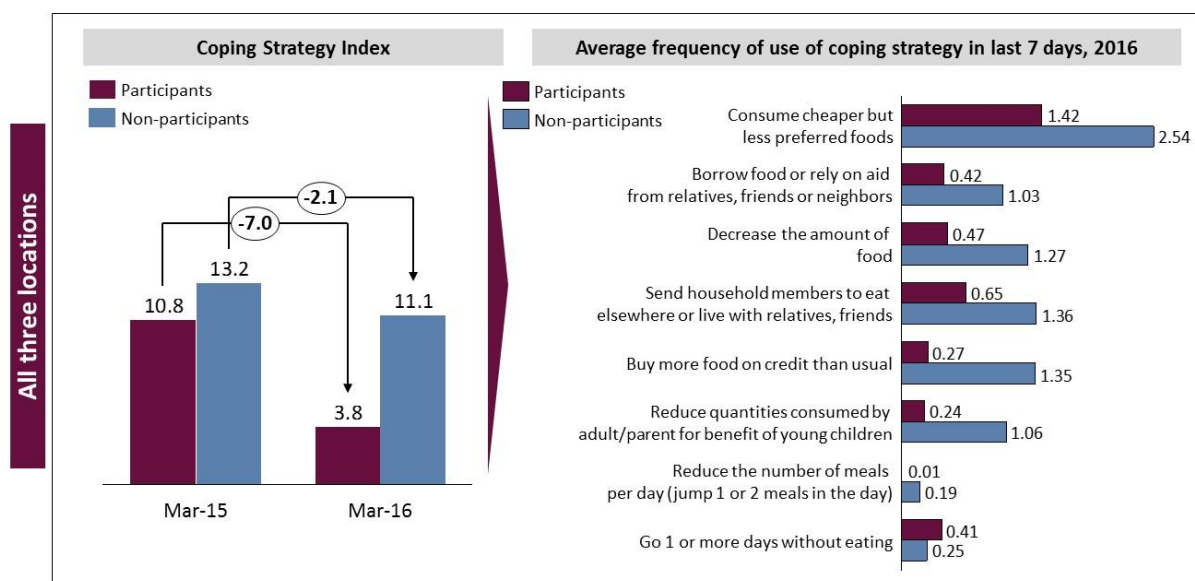
Figure 18: Evolution of Food Consumption Score by locations



c. Coping strategies

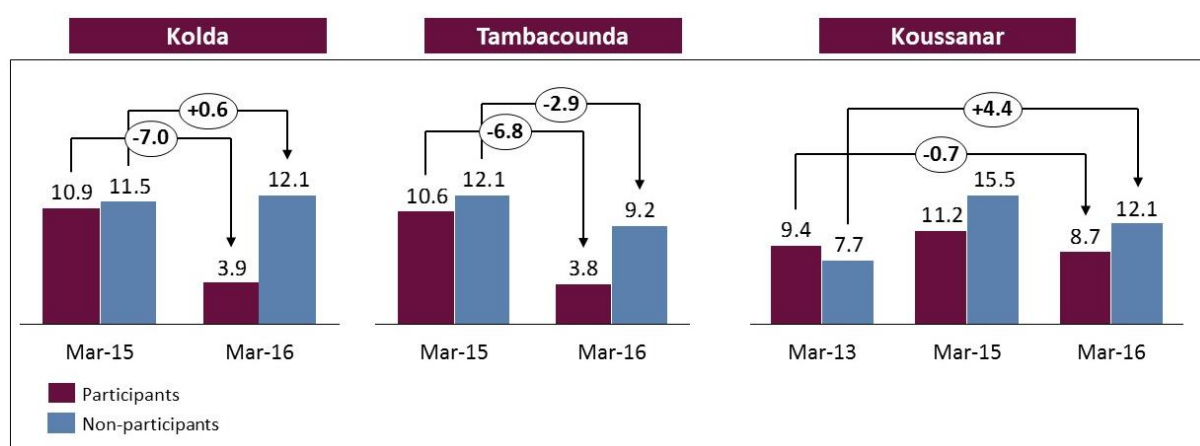
Improved food production drove a reduction in coping strategies for both groups, but the reduction was higher for program participants. Increased production and consumption mean both groups are less likely to resort to measures to cope against food insecurity risks. However, this reduction in usage of coping strategies is higher for program participants. Program participants experienced a seven-point reduction in their coping strategy index compared to a reduction of 2.1 points among non-participants. Practically, this means participants are less likely to resort to measures such as consuming cheaper but less preferable foods, borrowing food, decreasing the amount of food consumed, or buying more food on credit than usual. For example, while the average number of meals per week when participant households consume cheaper but less preferable foods is 1.42, the number for non-participants is 2.54.

Figure 19: Coping Strategy Index and average frequency of use of coping strategy in last seven days, 2016



Across all three locations, participants reported a higher drop in coping strategies compared to non-participants, with the biggest difference occurring in Kolda. The R4 Initiative's provision of food assistance to participants and support for increased crop production drove the reduction in CSI among program participants. In Kolda, participants reported a seven point drop in their Coping Strategy Index (CSI) while non-participants reported an increase by 0.6. In Tambacounda, participants reported a reduction in CSI by 6.8 as against a 2.9 reduction by non-participants. In Koussanar, consistent with food production and consumption trends since 2013, both participant and non-participant households reported an increase in their CSI between 2013 and 2015 and a subsequent reduction between 2015 and 2016. Overall, however, participants have performed better compared to non-participants. While participants report a 0.7 reduction in their CSI between 2013 and 2016, non-participants report an increase of 4.4 over the period.

Figure 20: Evolution of Coping Strategy Index by locations



4.3 Households' living standards

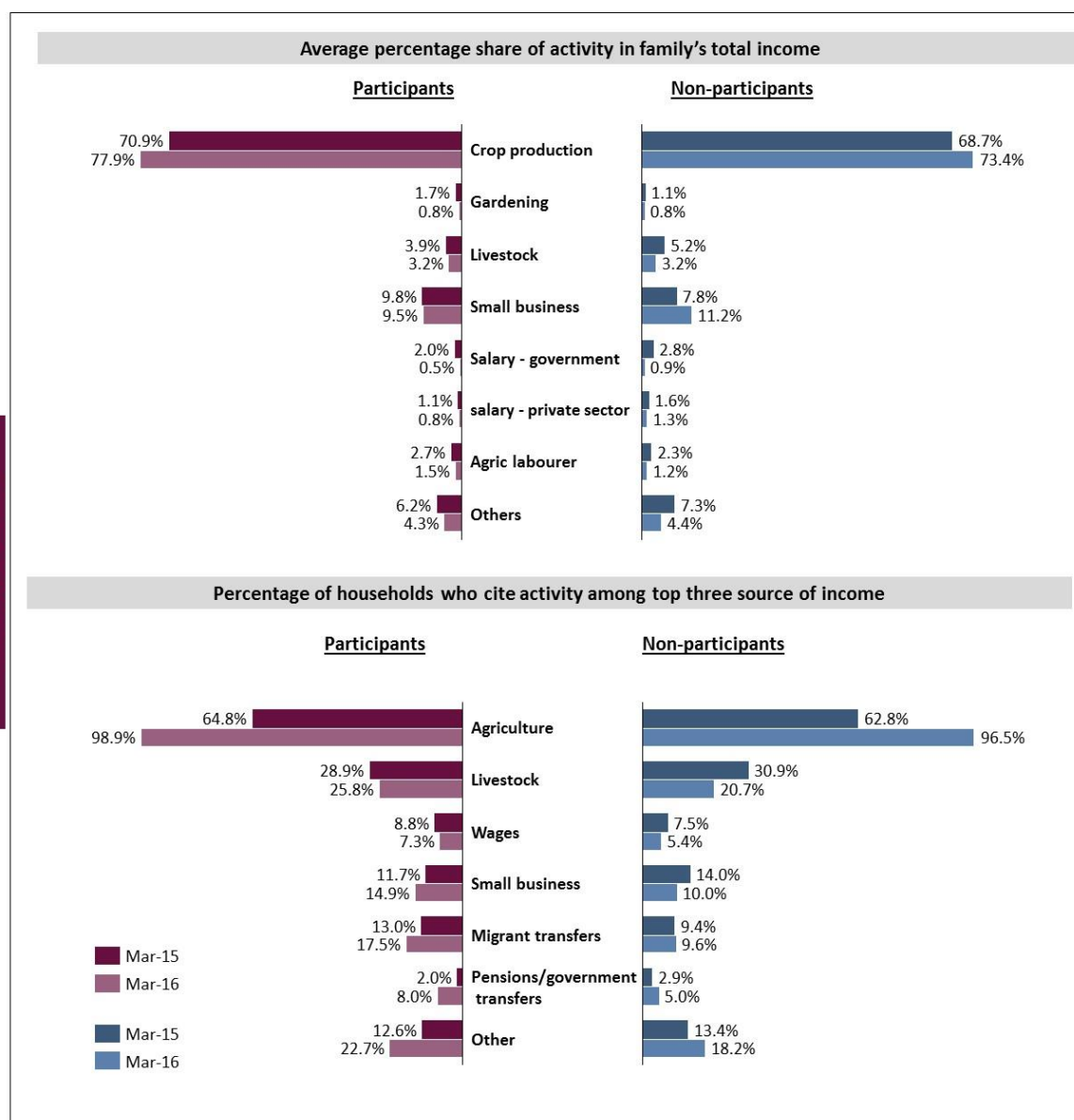
Summary: The study found that crop production accounted for a higher share of household total income among both participants and non-participants between 2015 and 2016, driven by increases in production. Between 2015 and 2016, however, program participants reported a greater increase in reliance on agriculture for their household income compared to non-participants. Program participants also witnessed a reduction in their average monthly expenditure while non-participants reported an increase. The increase in expenditure for non-participants was driven by increases in food-related expenditure, indicating that non-participants were purchasing more to make up for a less productive agriculture season compared to participants.

The percentage of non-participant households that perceive themselves as very poor relative to other households within their community is higher compared to participant households. Participants who received a loan from the program to undertake an income-generating activity were less likely to report that they faced income shocks, indicating that the loan component of the SFC enabled households to bolster their incomes.

a. Income sources

Among both participants and non-participants, crop production accounted for a higher share of total household income, driven by increases in production. For participants, crop production's share of total income increased from 70.9% to 77.9% between 2015 and 2016 while it increased from 68.7% to 73.4% for non-participants over the same period. The larger increase for program participants is consistent with the fact that they recorded greater increases in their agriculture output. Additionally, overall, we notice that agriculture (crops, gardening, and livestock) constitutes a slightly greater proportion of overall household income among participants (82%) compared to non-participants (77%). Participants also reported a slight decrease in the share of income that they receive from small businesses, from 9.8% to 9.5% between 2015 and 2016. On the other hand, the income share from small businesses increased among non-participants from 7.8% to 11.2% over the period. Aside from share of income, the percentage of participants who cited small businesses as one of their sources of income increased from 11.7% in 2015 to 14.9% in 2016 while it declined for non-participants from 14.0% to 10.0% over the period. This offers evidence for the R4 Initiative's effectiveness in supporting households' efforts to diversify sources of income through engaging in other revenue-generating activities. However, the higher dependence of participants on agriculture for income and decline in contribution of small businesses suggest more support is required to ensure that these extra revenue-generating activities translate into higher levels of income for households.

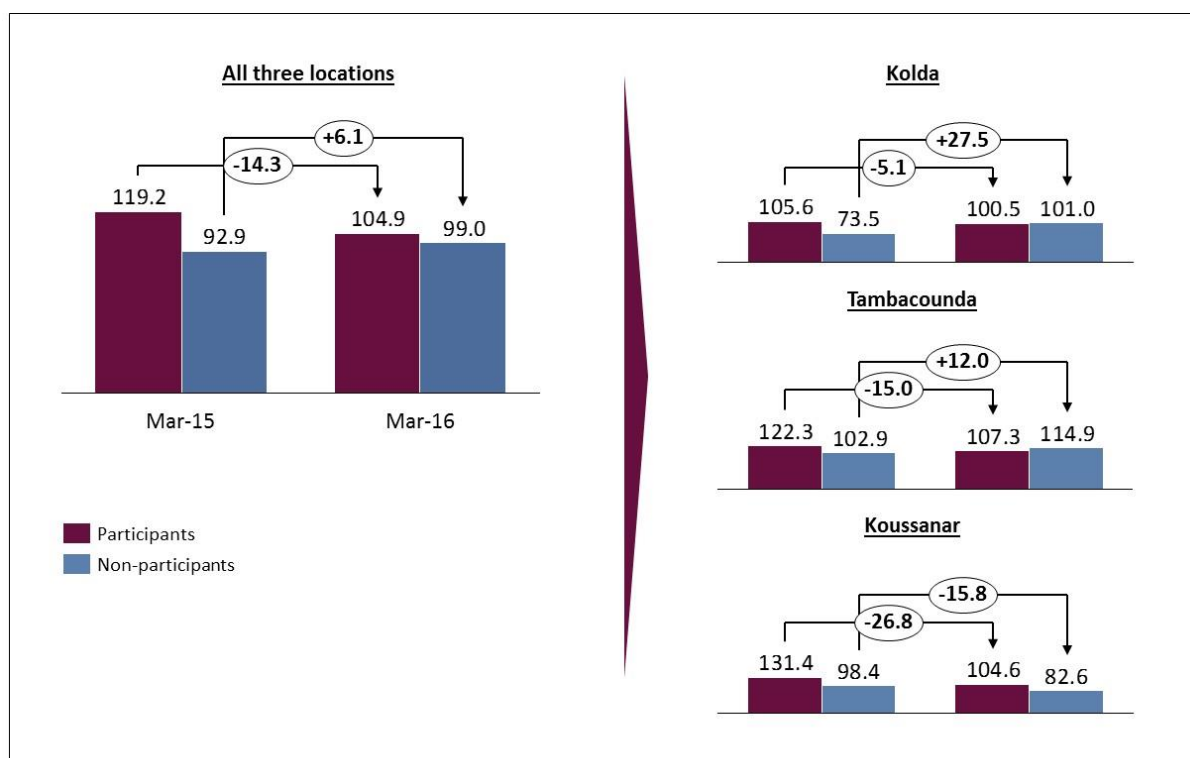
Figure 21: Average percentage share of activity in households' total income and percentage of households that cite activity among top three sources of income



b. Household expenditure

Across all locations, average monthly expenditure by non-participants increased while it diminished for participants. While non-participants reported an increase in monthly expenditure of about 6,100 CFA francs, participants reported a decline of about 14,300 CFA francs. In absolute terms, the average monthly expenditure for participants (104,900 CFA francs) is still higher than non-participants (99,000 CFA francs), but participants experienced an expenditure reduction between 2015 and 2016 of 12% while non-participants experienced an increase of 7% over the period. We observed this trend across each of the three project locations, with the biggest drop in expenditure occurring in Koussanar; here, both participants and non-participants experienced a decline in average monthly expenditure between 2015 and 2016, although the drop was larger for participants.

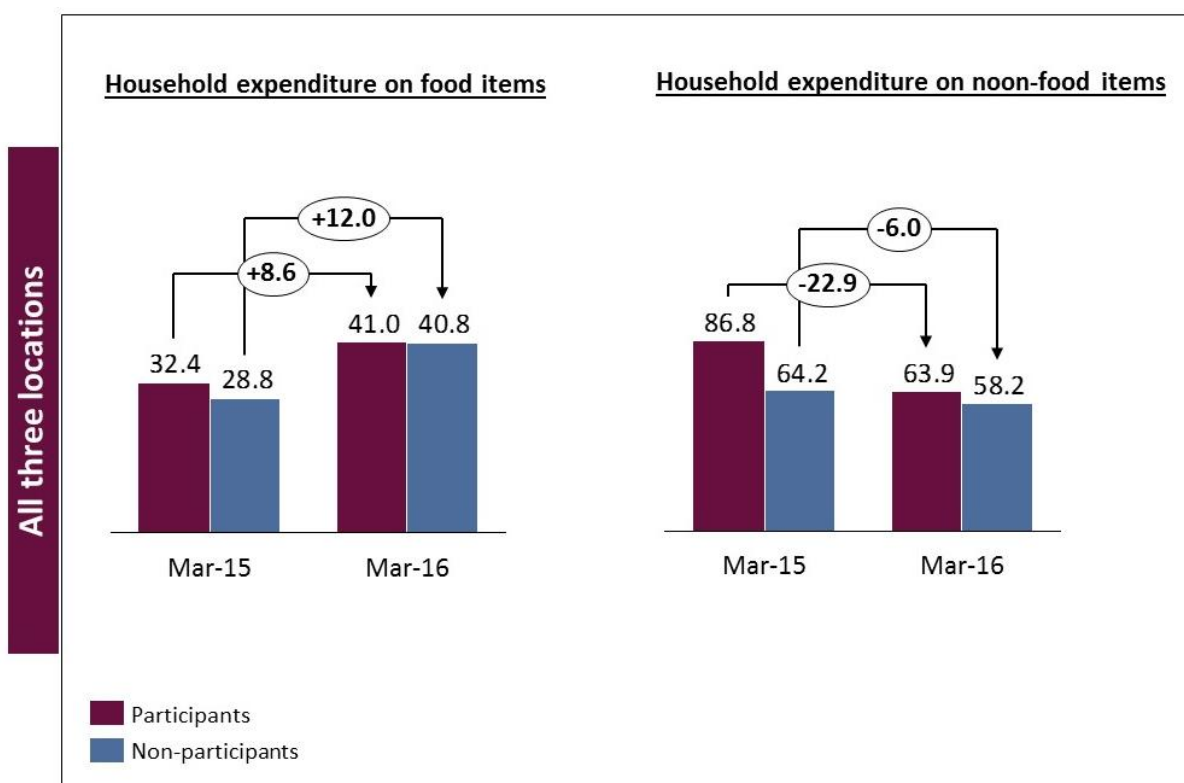
Figure 22: Average household expenditure during last 30 days (thousands of CFA francs)



When we separate food and non-food expenditure, we notice that both groups saw an increase in food expenditure, with non-participants experiencing a larger increase. For food expenditure, non-participants experienced a bigger increase of 12,000 CFA francs compared to 8,000 CFA francs among program participants. The increase in food expenditure may be lower among participants compared to non-participants because participants' relatively higher production levels, as well as food assistance received through FFA, mean that participants have less need to purchase food to meet their nutritional needs. In the case of non-food expenditure¹⁶, whilst both groups experienced a decline, the decline was higher among program participants compared to non-participants. Firstly, this may suggest that the relatively low levels of staple crop sales mean that despite greater increases in crop production, program participants did not generate increased cash income to spend on other household expenditures. Secondly, it is possible that participant households spent on other investments that are not captured in the data collected for household expenditure. For example, program participants report a bigger increase in the average number of livestock, such as cattle and sheep they own, compared to non-participants. Additionally, the bigger increase among the percentage of participant households that cite a small businesses as a source of income suggests participants may have increased expenditure on small businesses.

¹⁶ Expense categories include housing expenses (rent, electricity bills, water, cooking fuel/gas) expenses on services (transportation, communication, labor), other non-food daily expenses (soap, tobacco, alcohol), household equipment (radio, TV, telephone, etc.), medical expenses, education, school fees, clothing/shoes, agricultural inputs (seeds, fertilizers, pesticides, veterinary products, food / livestock maintenance), loan repayment and sending money to dependents, ceremonies (baptism, marriage, funeral, etc.), construction/repair of dwelling places.

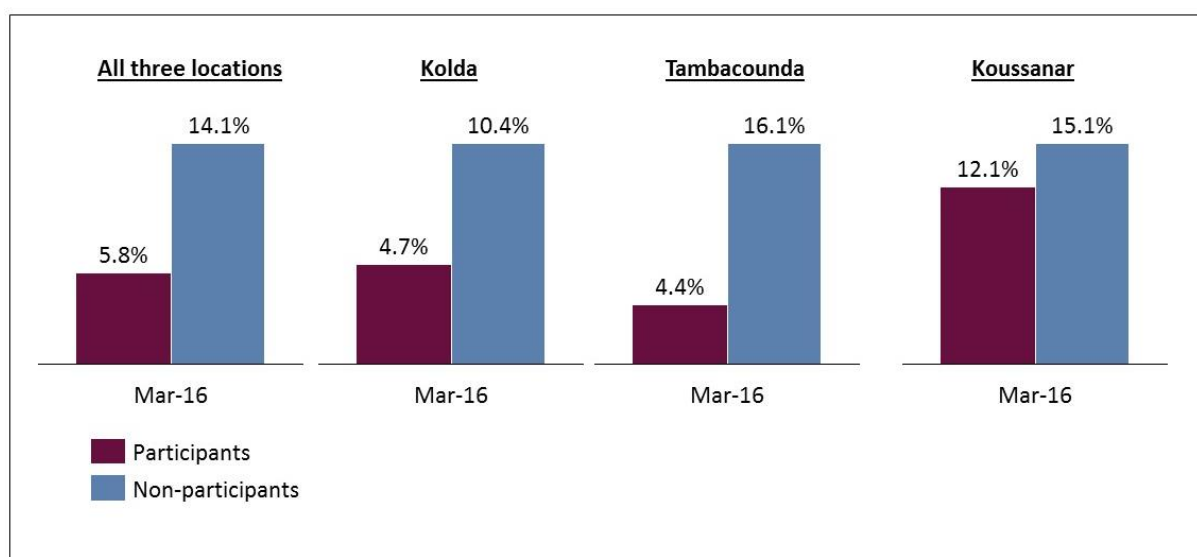
Figure 23: Average household expenditure on food and non-food items during last 30 days (thousands of CFA francs)



c. Household perceptions of poverty

The percentage of non-participant households that perceive themselves as very poor relative to other households within their community is higher compared to participant households. Across all three locations the percentage of participant households that identify themselves as very poor compared to other households in their community is 5.8% compared to 14.1% among non-participants. In Kolda, 4.7% of participant households and 10.4% of non-participant households identify themselves as very poor compared to others in their community. In Tambacounda, 4.4% of participant households and 16.1% of non-participant households identify themselves as very poor compared to others. In Koussanar, 12.1% of participant households and 15.1% of non-participant households identify themselves as very poor compared to others within their community. Participant households' greater increases in crop production and improved food security situation, as measured by FCS and CSI, are likely to have contributed a better perception of household poverty among participants compared to non-participants.

Figure 24: Percentage of households that indicate they are very poor compared to others within the community



d. Household savings and access to credit

Text box 4: R4 support for saving groups

The risk reserve and prudent risk taking components of the R4 Initiative supported participant households in increasing savings and gaining access to small credit to cope with the effects of shocks and to undertake income generating activities. Inspired by the traditional savings systems, the program mobilized participants into small groups of 15 to 25 to create a joint pool of savings based on weekly contributions from members. The money collected is distributed to group members in the form of loans; the interest earned on these loans gradually increases the capital reserves of the group. In Tambacounda region (including Koussanar), a total of 389 groups were formed through the program, 80% of which were women-only groups. Membership of these groups included 5,794 women and 1,591 men. In Kolda, the Initiative has supported the creation of a total of 192 savings groups covering 90 villages. Total membership of the groups in Kolda region is 4,305, of which 78% are women. To support the effective functioning and sustainability of these groups, the R4 Initiative's implementation partner, ONG La Lumière, assigned a facilitator to train group members in financial literacy and numeracy. Trained leaders then help replicate the model with other groups, thereby multiplying the impact.

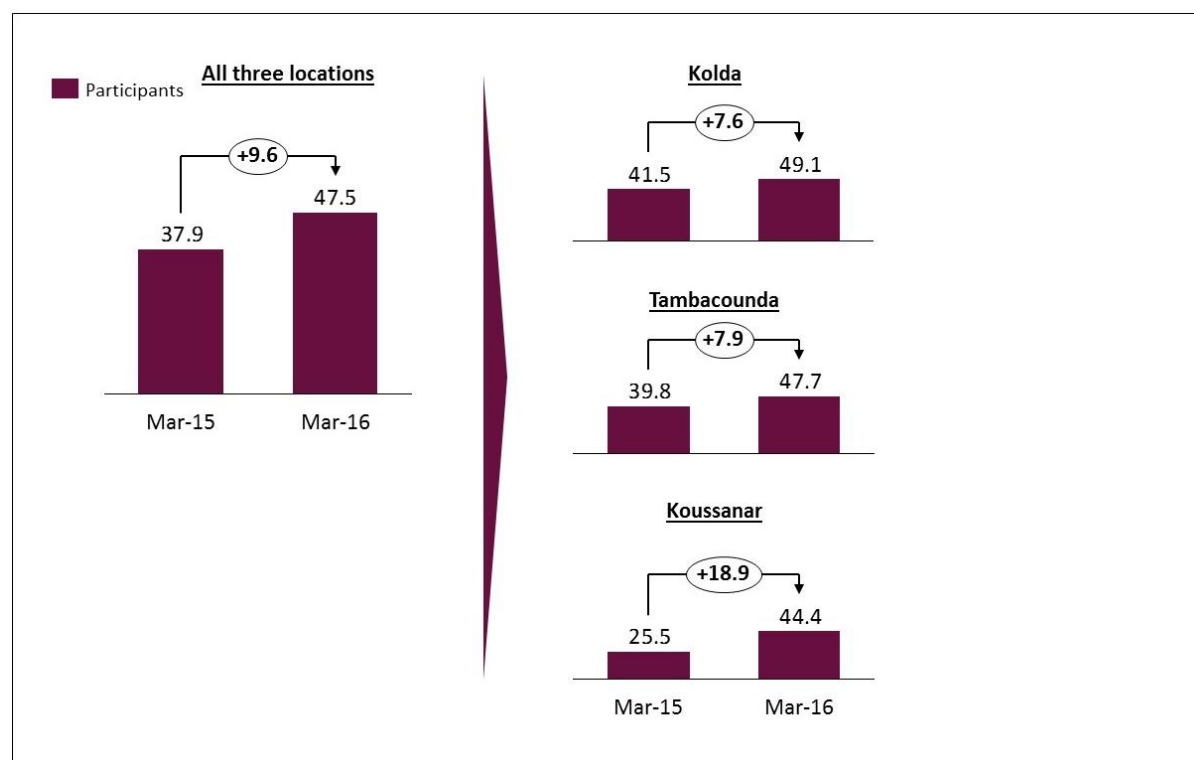


The saving group of Ribot Escale in action, with the woman responsible for the safe box collecting members' contributions. The saving groups build risk reserves, a base for credit, and a buffer for unexpected events, while providing training on financial literacy and numeracy.

Photo credit: Carla De Gregorio, March 2015

According to household surveys, an increased percentage of participant households now save with savings groups mobilized by the Initiative. Across all three locations, the percentage of households indicating that they save with groups mobilized by the program increased by 9.6 percentage points, from 37.9% in 2015 to 47.5% in 2016. In Kolda, we see a 7.6 percentage point increase in households that save through SFC groups, from 41.5% in 2015 to 49.1% in 2016. In Tambacounda, the percentage of participant households saving with SFC groups increased by 7.9 percentage points from 39.8% in 2015 to 47.7% in 2016. For Koussanar, we see an 18.9 percentage point increase from 25.5% in 2015 to 44.4% in 2016.

Figure 25: Percentage of participant households that save in SFC groups

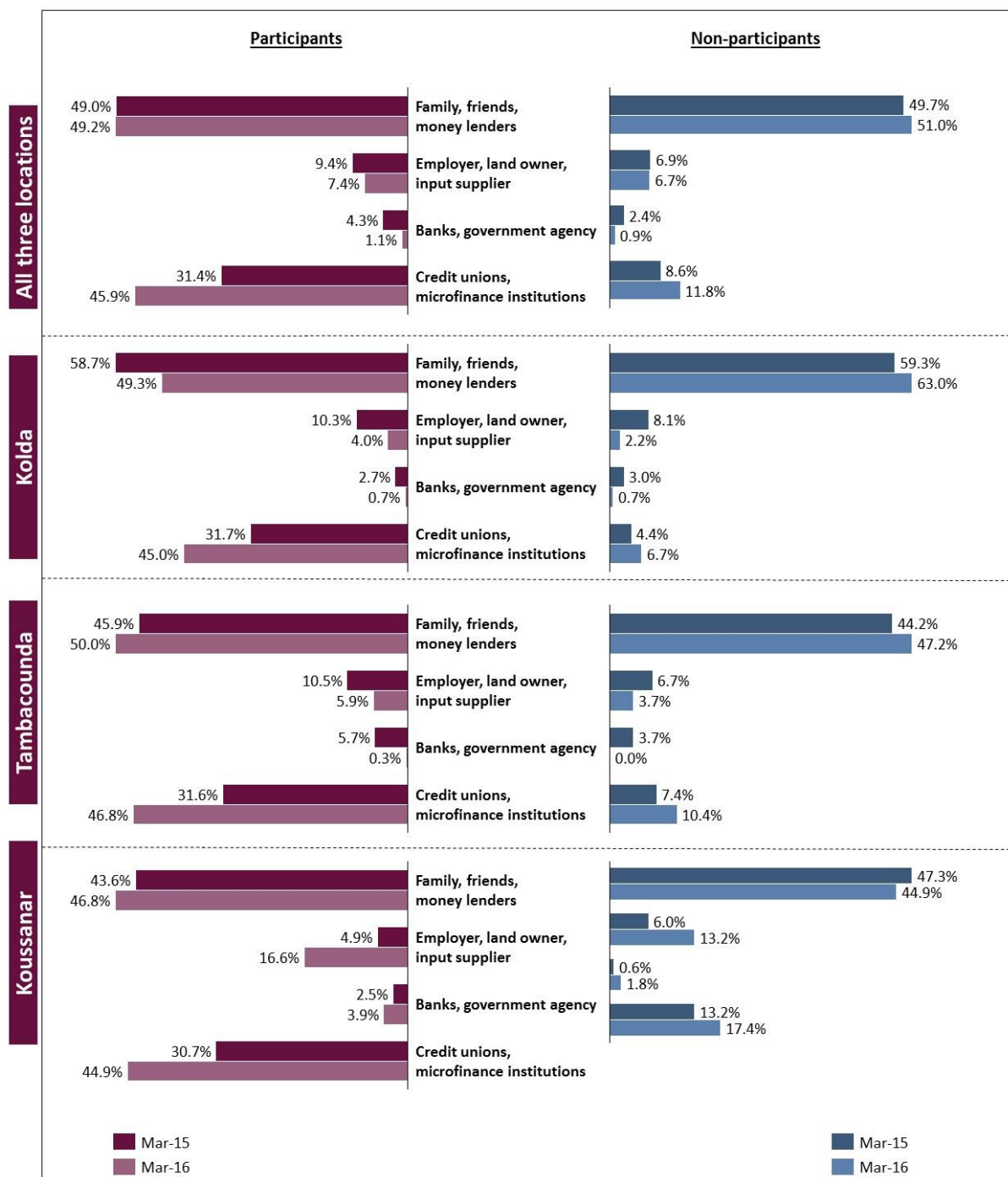


Also, the number of participant households that saved experienced an increase of about 21 percentage points, from 38.3% to 59%. For non-participants, the same decreased from 32.6% to 29%.

The savings mobilized through saving groups also provided an opportunity for households to access credit, further bolstering financial inclusion. Across all three locations, participant households that have taken credit from credit unions and microfinance institutions over the past 12 months increased by 14 percentage points from 31.4% in 2015 to 45.6% in 2016 while non-participants witnessed a relatively smaller increase of about three percentage points from 8.6% in 2015 to 11.8% in 2016. In Kolda region, participant households that have taken credit from credit unions or microfinance institutions increased by about 13 percentage points for non-participants from 31.7% in 2015 to 45%

in 2016 while non-participants witnessed an increase of about two percentage points from 4.4% in 2015 to 6.7% in 2016. In Tambacounda, the percentage of participant households that have taken credit from credit unions or microfinance institutions increased by about 15 percentage points from 31.6% in 2015 to 46.8% in 2016 compared to a three-percentage-point increase among non-participants from 7.4% in 2015 to 10.4% in 2016. Similarly, in Koussanar, program participants experienced an increase of about 14 points in the percentage of participants who have taken loans in the past 12 months from 30.7% in 2015 to 44.9% in 2016. On the other hand, non-participants in Koussanar witnessed a four-percentage-point increase from 13.7% in 2015 to 17.4% in 2016.

Figure 26: Percentage of households that have taken a loan from various sources



Text box 5: R4's revolving credit fund and support for income-generating activities

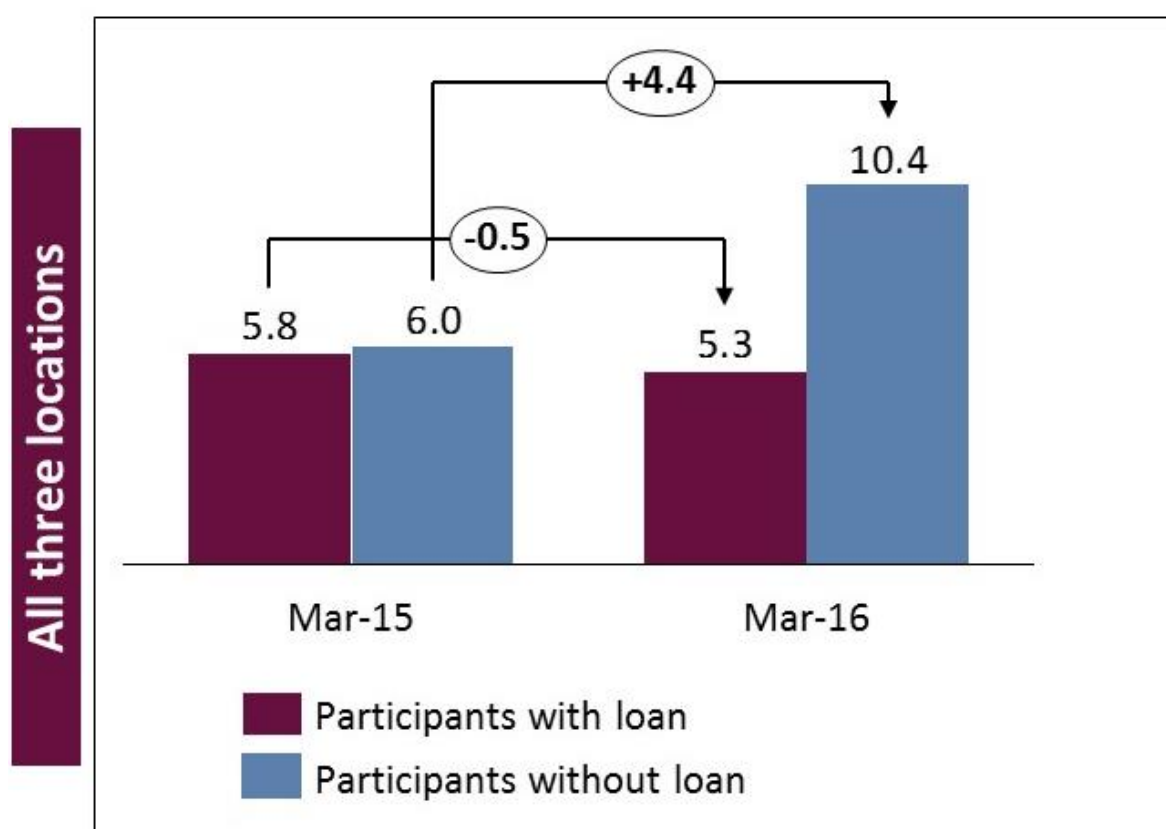
Part of the credit that participant households accessed came out of a revolving credit fund created by the Initiative to support households in undertaking income-generating activities in groups of common economic interest. The program supported the creation of common economic interest groups, which are composed of more established savings groups whose members would like to implement a joint income-generating activity. The program empowered these groups by training them on how to successfully manage their income-generating activities, financial management, group dynamics, and setting up internal structures, including a management committee for each association. Access to credit for income-generating activities was made available through an initial fund of US\$ 40,000 or 24 million CFA francs established by Oxfam. Examples of activities supported by these loans include small trade, fish processing, and processing of other food crops.



Two women in the village of Kalibirom in Koussanar hold packaged couscous made from rice and maize that they produced with credit support from R4.

The loan component of the R4 program bolstered the income of participants who took a loan, thereby reducing their exposure to income shocks relative to other participants who did not take a loan. Across all three locations, among program participants who took a loan through the SFC methodology, the percentage of households that reported experiencing an income shock such as job loss, ceasing to receive remittances from family and friends or the termination of other commercial activity decreased from 5.8% in 2015 to 5.3% in 2016. On the other hand, among program participants who did not receive credit from the Initiative, the percentage of households that reported exposure to income shocks increased from 6% in 2015 to 10.4% in 2016. This disparity suggests that the micro-loans helped program participants engage in income-generating activities that increased their resilience to income shocks.

Figure 27: Percentage of households that indicate they experienced an income shock



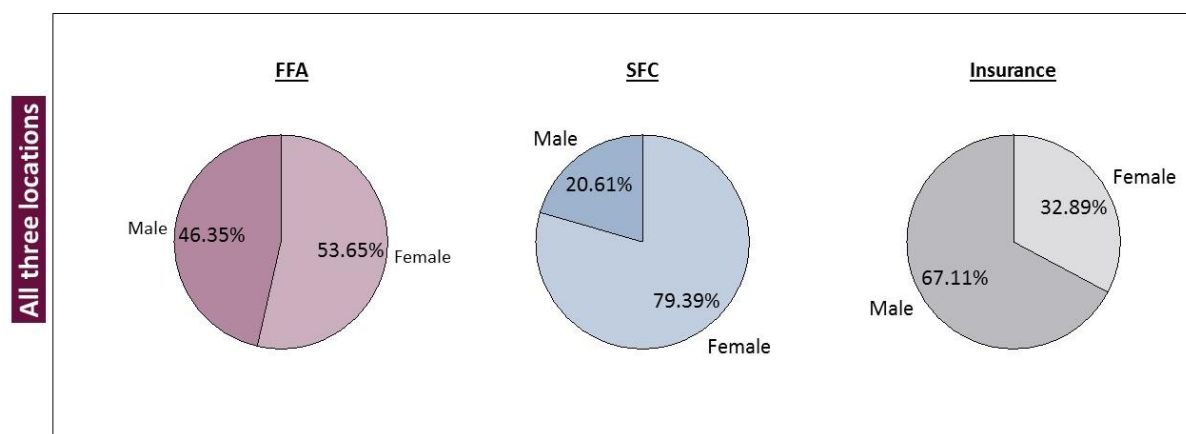
4.4 Impact on gender empowerment

Summary: While formal household leadership continues to be dominated by men in both participant and non-participant households, we see evidence of increased decision-making responsibility among women in participant households. For example, women are involved in making decisions on the use of farmland in 11% of participant households compared to 6% of non-participant households. The Savings for Change (SFC) component also provided an avenue for women to save and acquire small loans to undertake income-generating activities such as rice farming, peanut farming, vegetable cultivation, and small trade.

a. Gender composition of program

Women participated in large numbers across all three components of the program (FFA, SFC, and insurance) and constituted the majority of participants in the Savings for Change and Food for Assets components. The proportion of women among participants benefiting from the SFC component is almost 80%. The program supported these women in SFC groups in undertaking income-generating activities such as small trade, processing of cereals, and fish processing. Additionally, women constitute about 53.7% of participants in the FFA component and 32.9% of participants in the insurance component of the program.

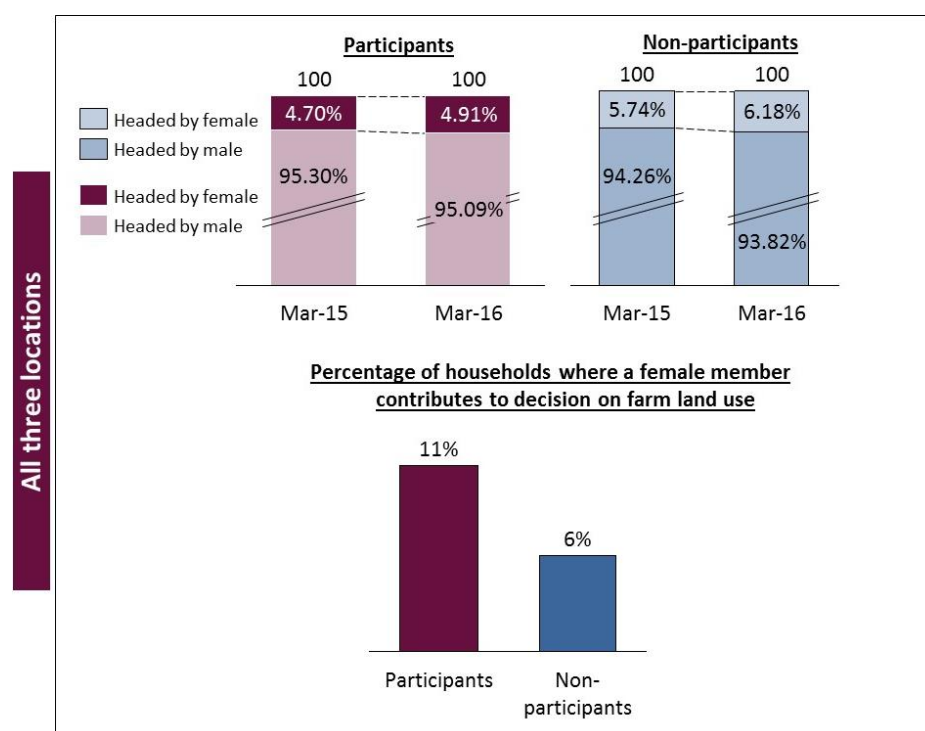
Figure 28: Gender composition of R4 program



b. Gender empowerment in decision-making and economic participation

While the majority of households in both groups are still headed by men, women in participant households are more likely to shape economic decisions. There is little difference between participants and non-participants in the gender of the head of the household, with 95% of participant households and 93.8% of non-participant households headed by men. This is consistent with a 2013 census report from Agence Nationale de la Statistique et de la Démographie (ANSD), which indicated that 94% and 96% of households that practice agriculture in Tambacounda and Kolda, respectively, are headed by men.¹⁷ However, we see evidence of increased decision-making responsibility on the part of women among participant households. For example, for 11% of participant households, women are involved in decisions on the use of farmland as opposed to 6% among non-participants.

Figure 29: Gender of head of household and female participation in farming plot decision



¹⁷ ANSD, "Recensement Général de la Population et de l'Habitat, de l'Agriculture et de l'Elevage (RGPHAE 2013)," September 2014.

During focus group discussions, women also indicated that the program had created opportunities for them to increase their economic participation. The SFC component provided an avenue for women to save and acquire small loans to undertake income-generating activities such as rice farming, peanut farming, vegetable cultivation, gardening, and small trade. Additionally, women acquired skills such as entrepreneurship, communications, and financial management, which contributed to economic empowerment. Through these initiatives, women increased their support in meeting household needs, particularly those relating to nutrition and support for children's welfare (clothing, healthcare, and education). Additionally, women's groups mobilized for program activities—such as savings groups and groups of common economic interests, described earlier—have strengthened bonds of trust and social interactions among participants.

"With the program, I have increased my participation in supporting my family's meals, education, health, and clothing needs. I do this by practicing gardening and rice production".



Female participant in
Tankanto Escalé

Text box 6: Savings groups and women's economic empowerment

A review of several studies from South Asia and sub-Saharan Africa on the effectiveness of self-help groups (SHGs) by the Evens School of Public Affairs finds that participation in SHGs is generally associated with positive financial outcomes, including increased savings, access to credit, and ownership of assets. Nineteen of twenty-four studies reported that interventions that establish or work with savings groups (e.g., rotating savings and credit associations or savings and internal lending communities) allowed members to build financial discipline and skills. Bank linkage programs allowed groups to mobilize larger amounts than internal savings would allow. Eight of nine studies reporting on assets found significant and positive increases in asset ownership. Eight studies found that members of groups could access funding for micro-enterprise, but the overall viability of these enterprises has not been tested.

On women's empowerment, the review also assessed studies related to empowerment outcomes such as increased self-confidence, perceptions of autonomy, knowledge of important issues, business training, negotiation skills, financial independence, community and political involvement for members, and changes in community norms. Four of the eight moderately-high or high quality studies found consistently positive results across empowerment outcomes. The others, while generally positive, found mixed, non-significant, or negative effects in one or more empowerment sub-areas. Across all studies, increased control over decision-making was positively associated with SHG participation. On subjective well-being and autonomy, all but two studies reported positive effects. In addition, twelve studies that measured decision-making found that group members' reported control over decision-making within the household and in the community improved significantly more than that of non-group members. Most studies measuring women's presence in society report that group members feel more comfortable and able to engage in economic and social activities outside of the home.¹⁸

4.5 Impact on household resilience to climate change shocks

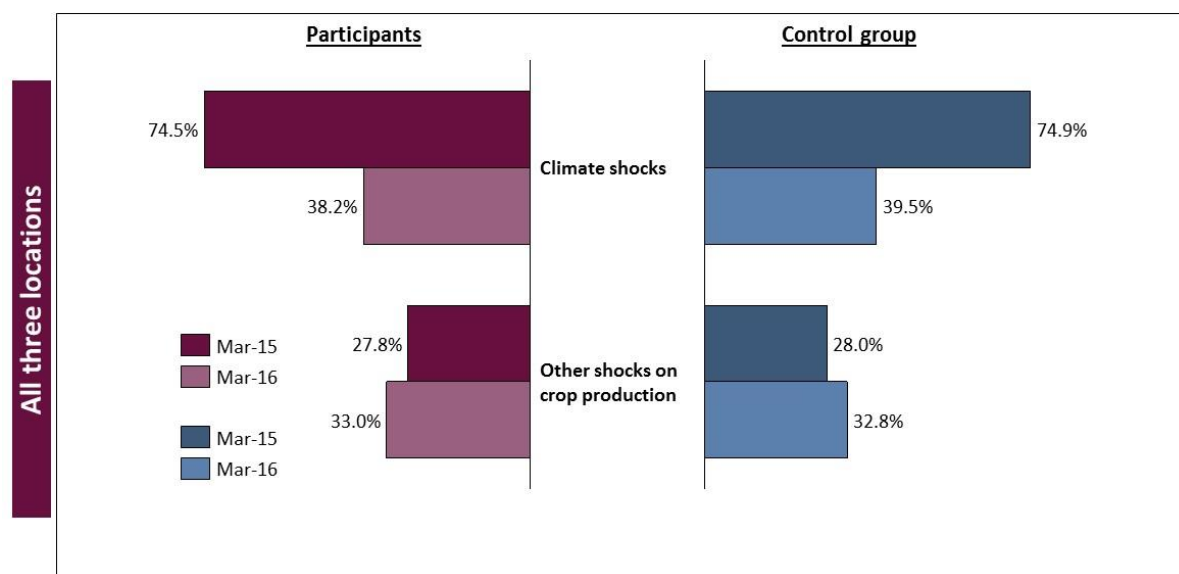
a. Overview of community exposure to climate shocks

Both participants and non-participants reported a reduction in exposure to climate shocks compared to 2015, though about 40% of households indicated that they still faced climate shocks. Climate shocks are shocks relating to extremely low or excessive rainfall as well as the lack of uniform distribution of rainfall across the agriculture season. The percentage of participant households that

¹⁸ Anderson et al., "Self-Help Groups in Development: A Review of Evidence from South Asia and Sub-Saharan Africa," Evans School Policy Analysis and Research (EPAR), December 2014.

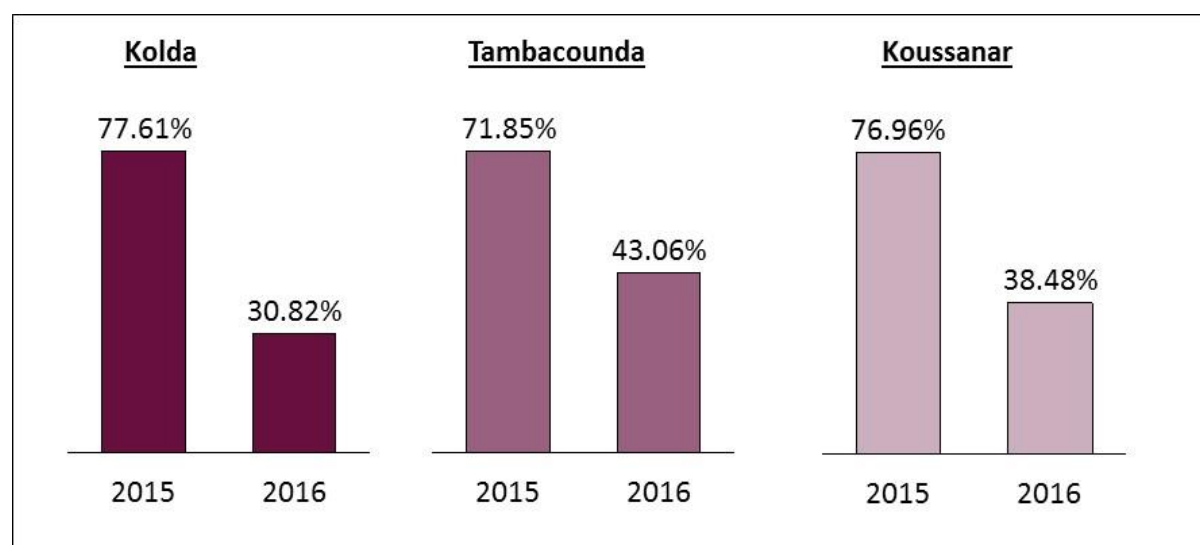
indicated they faced climate shocks decreased from 74.5% in 2015 to 38.2% in 2016. Non-participants also experienced a similar reduction from 74.9% in 2015 to 39.5% in 2016. Despite a late onset of the rains and several dry spells experienced in Tambacounda, overall the Agence Nationale de l'Aviation Civile et de la Météorologie classified the rainfall situation in both Tambacounda and Kolda in the last season as normal in relation to historical averages and an improvement over the levels experienced in the 2014-2015 agriculture season.¹⁹ Despite a reduction in exposure to climate shocks, both participants and non-participants reported a five-percentage-point increase in exposure to other shocks affecting crop production, including pest invasion and disease outbreak.

Figure 30: Households' exposure to shocks, %



We found a reduction in exposure to climate shocks in each of the three locations, with households in Kolda reporting the largest reduction. In Kolda, 30.8% of households indicated that they were exposed to climate shocks, compared to 38.5% in Koussanar and 43% in Tambacounda.

Figure 31: Households' exposure to climate shocks by location



¹⁹ Meteorological data accessed at: <http://www.anacim.sn/oldsite/IMG/pdf/-185.pdf>

b. Program impact in managing effects of climate shocks

The R4 program helped limit the negative impacts of climate shocks.

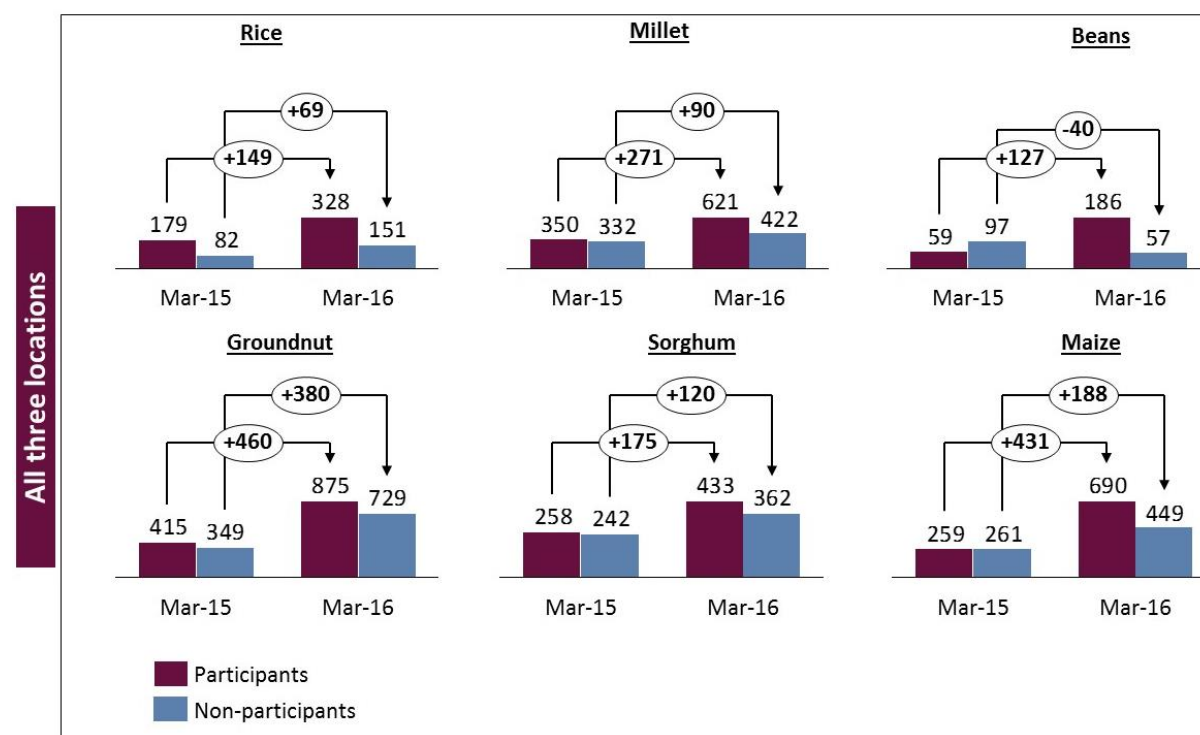
A comparison of participant and non-participant households that indicated that they were exposed to climate shocks in both the 2014-2015 and 2015-2016 agriculture seasons reveals that program participants experienced greater increases in average household production of staple crops over the period. For rice, program participants who indicated they were exposed to climate shocks record an increase in production by 149 kg per household from 2015 to 2016 as opposed to an increase of 69 kg per non-participant household. For millet, participant households exposed to climate shocks increased their output by 271 kg per household from 2015 to 2016 while non-participants exposed to climate shocks increased their output by 90 kg. The trend was similar for maize, sorghum, groundnuts, and beans—participants increased their production by an average of 127 kg while non-participants affected by the same shocks saw their production fall by 40 kg. R4 enabled households to increase their use of fertilizer and improved seeds while practicing improved water management activities, thereby limiting the adverse impacts of shocks. Specifically, the development of lowlands for rice cultivation, development of water regulation works, implementation of soil defense mechanisms, and compost making enabled program participants to experience greater increases in their production compared to non-participants.

"Before the R4 Initiative, we had no strategy to cope with shocks. Now, if you have insurance, you will be re-funded. We also receive food assistance through the program."



Farmer in Dawady

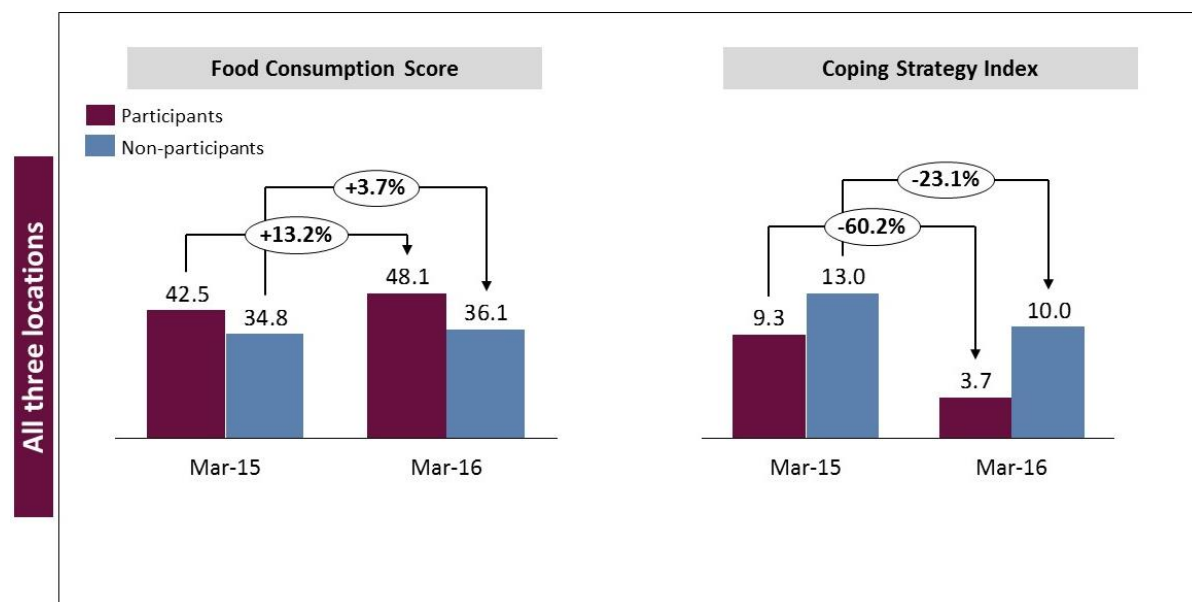
Figure 32: Average household production volume of staple crops for households exposed to climate shocks, kilograms



The program helped households that were affected by climate shocks to maintain their FCS. The increase in production allowed farmers to diversify food consumed and reduce the use of coping strategies. Thus participant households, although affected by climate shocks, experienced an increase in their FCS by 13.2%. Though this is much lower than the increase of 27% in FCS experienced by all participant households (including those not affected by climate shocks), it is much higher than the

3.7% increase recorded by non-participant households that were also exposed to climate shocks. Similarly, the reduction in the CSI for participants exposed to climate shocks was about 60.2% as opposed to 23.1% for non-participants.

Figure 33: Food Consumption Score and Coping Strategy Index for households exposed to climate shocks



4.6 Impact on community-level resilience and solidarity

The increase in percentage of heads of households who view others as generally trustworthy is higher for participants compared to non-participants. The R4 Initiative engendered trust among participants by creating new social groups or supporting existing structures within communities, which served as the basis for improved social interactions and conflict resolution. For example, by creating savings groups within the communities that helped members save together and support each other in times of hardship, the program's SFC methodology promoted mutual understanding and trust. The training provided by the program's facilitators on managing effective group dynamics and organizational effectiveness strengthened the capacity of communities to manage their differences and undertake joint approaches to solving problems. In Kolda, for example, we found an increase of four percentage points in the proportion of participants who perceived others as being trustworthy, and a corresponding reduction in perceptions of others as untrustworthy. On the other hand, among non-participants, the portion of those who perceived others as trustworthy decreased by eight percentage points with a corresponding increase in perceptions of untrustworthiness. During focus group discussions in Kolda, participants revealed that the R4 Initiative contributed to cohesion within the community by making it possible for the community to undertake joint activities between villages that were previously not talking to each other. In Tambacounda, as well, the increase in the percentage of program participants who perceived others as trustworthy was greater than the increase among non-participants. In Koussanar, although there was an increase in the percentage of participants who perceive others as trustworthy (from 65.8% in 2013 to 91.7% in 2016), the percentage increase was relatively small compared to non-participants (from 64.5% in 2013 to 93.2% in 2016). The relatively lower increases in perceptions of trust among participants in Koussanar can be explained by the

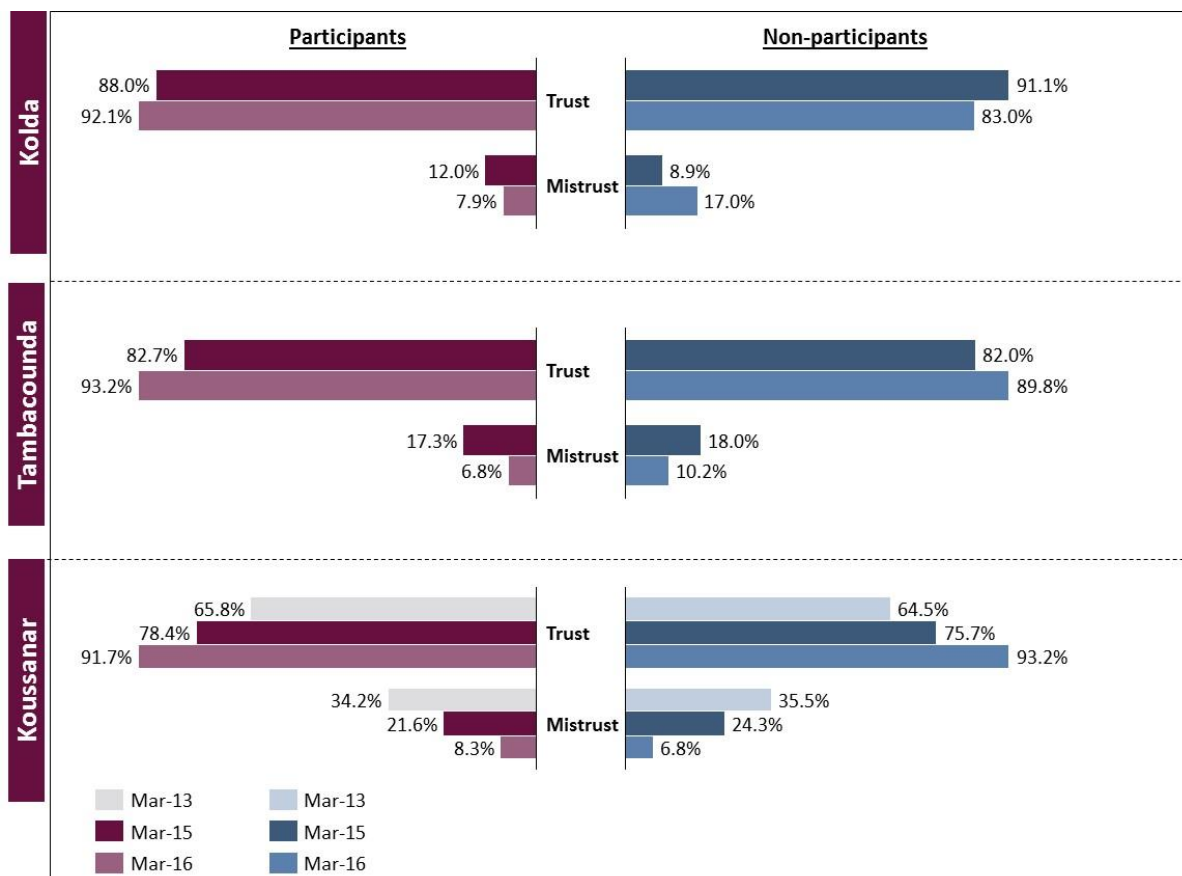
"In the past, there was a misunderstanding between some villages in the Bagadadji cluster, but with R4, members of these villages are meeting, talking and jointly implementing community projects such as constructing stone barriers and dredging of ponds under the FFA component."



NGO worker, ONG La Lumiere, Kolda

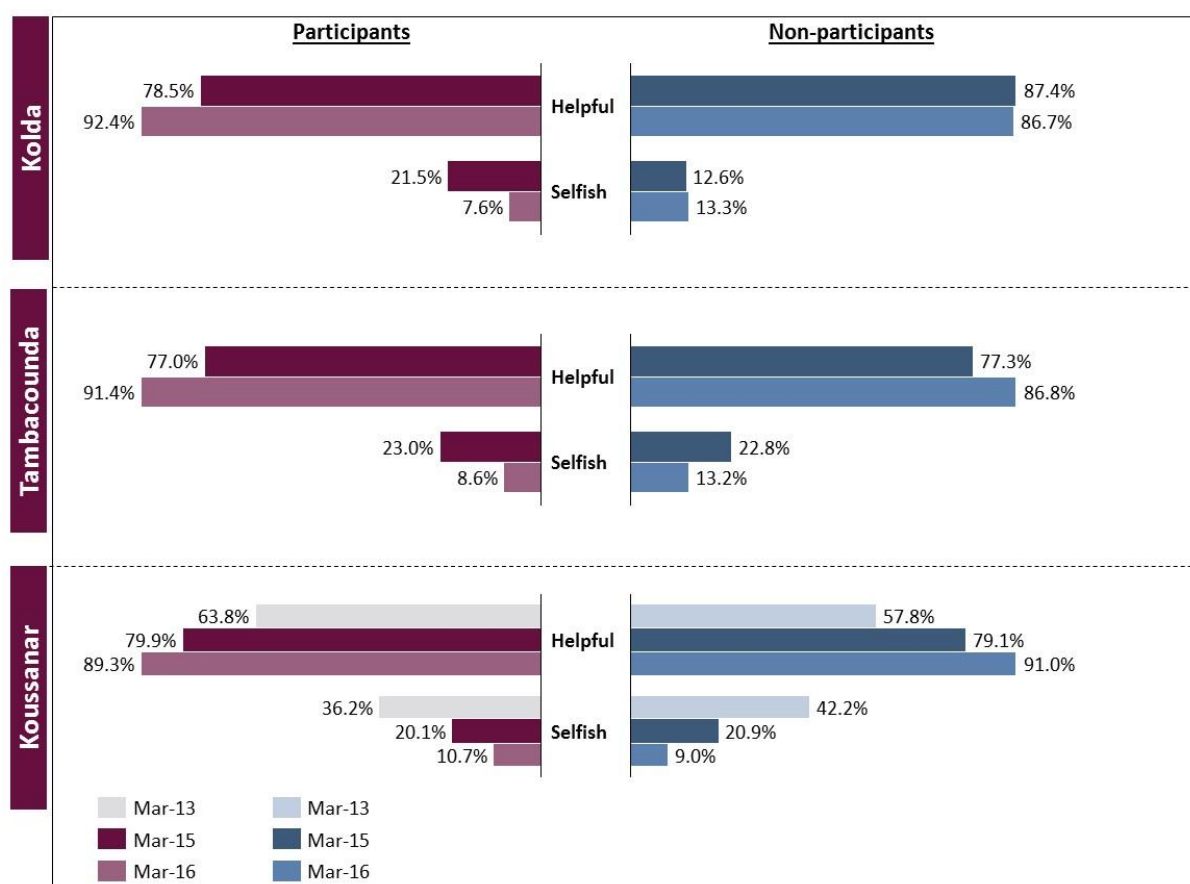
different approach toward implementing the FFA component in that location. Whereas in Kolda and Tambacounda the majority of participants cultivated rice in community fields that were shared among program participants, most FFA participants in Koussanar received support to cultivate rice on their own farms, thereby reducing opportunities for community bonding through joint participation in the development of lands.

Figure 34: Percentage of heads of households that perceive others as trustworthy



The increase in the percentage of heads of households who view others as generally helpful is higher for participants. Across all three locations, 91% of participants described members of their communities as helpful, representing a jump of almost 13 percentage points compared to 2015, while the jump is less than 8 percentage points for non-participants. For Kolda, perceptions of others' helpfulness among participants went up by 14 percentage points while non-participants reported a reduction in the same category.

Figure 35: Percentage of heads of households who perceive others as helpful



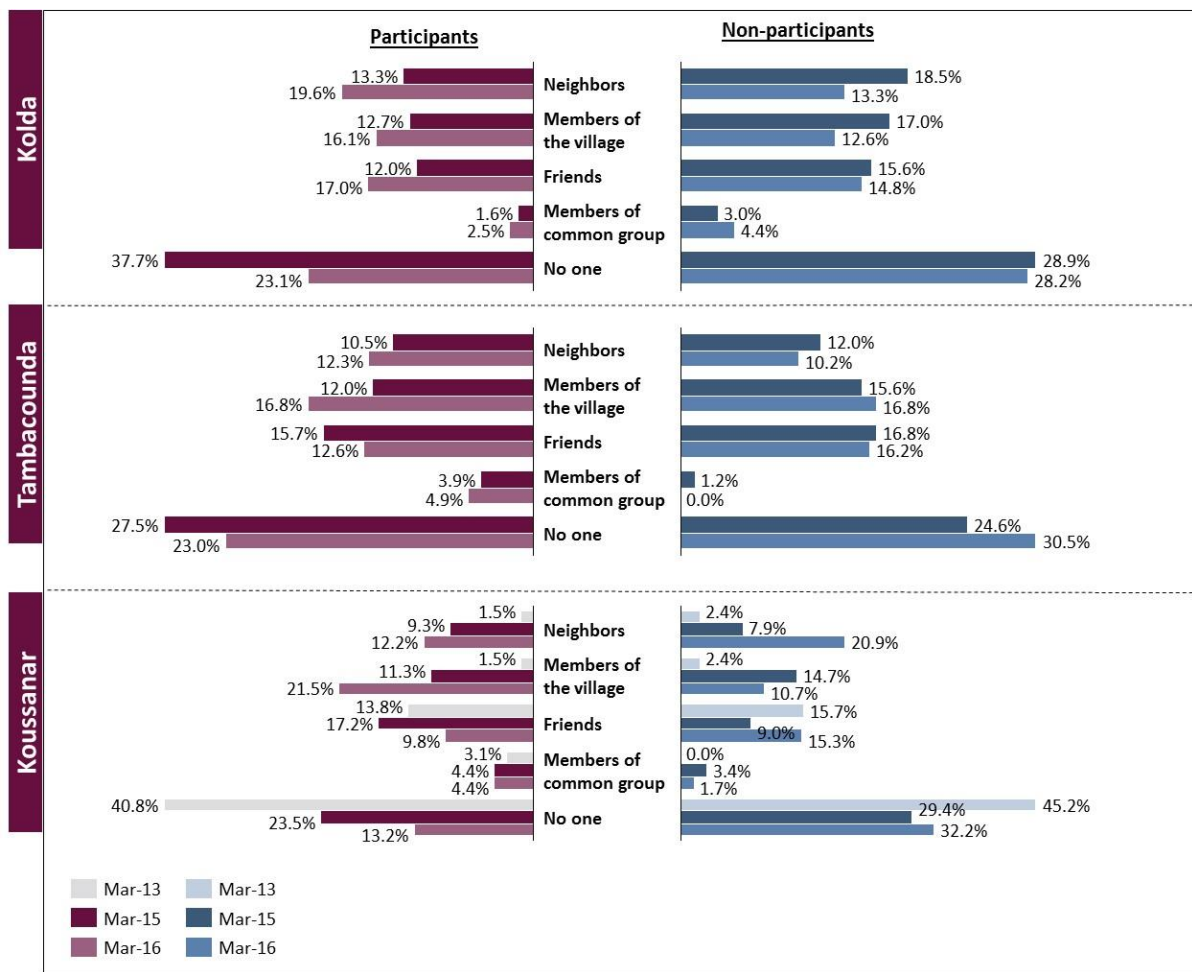
Across all three locations, participants were more likely than they were a year ago to turn to people within their neighborhood for support during difficult times—a measure of strengthened community bonds. The program has contributed to the improvement of social support systems in the participating communities by reinforcing the bonds of solidarity among the participants, which has led to an increase in the proportion of households that, during difficult periods, would turn to their neighbors, other village members, and friends for support. Participants were also less likely to indicate that they had no one to support them during difficult times. In Kolda, for example, between 2015 and 2016, the percentage of participants who indicated they would call on their neighbors increased by more than six percentage points; the percentage who would call on members of the village increased by more than three percentage points; and the percentage who would call on friends increased by seven percentage points. On the other hand, non-participants experienced a reduction across all three indicators. Also, the percentage of heads of households who said they had no one to turn to for support decreased significantly between 2015 and 2016 for participants in Kolda, Tambacounda, and Koussanar while non-participants witnessed significant increases in Tambacounda and Koussanar as well as a mild decrease in Kolda.

"R4 increased solidarity in our village by reinforcing friendship, cordiality and understanding among beneficiaries."



Farmer in Missirah,
Tambacounda

Figure 36: Whom households turn to when faced with bad harvest, %



5 Analysis of factors that drive program performance

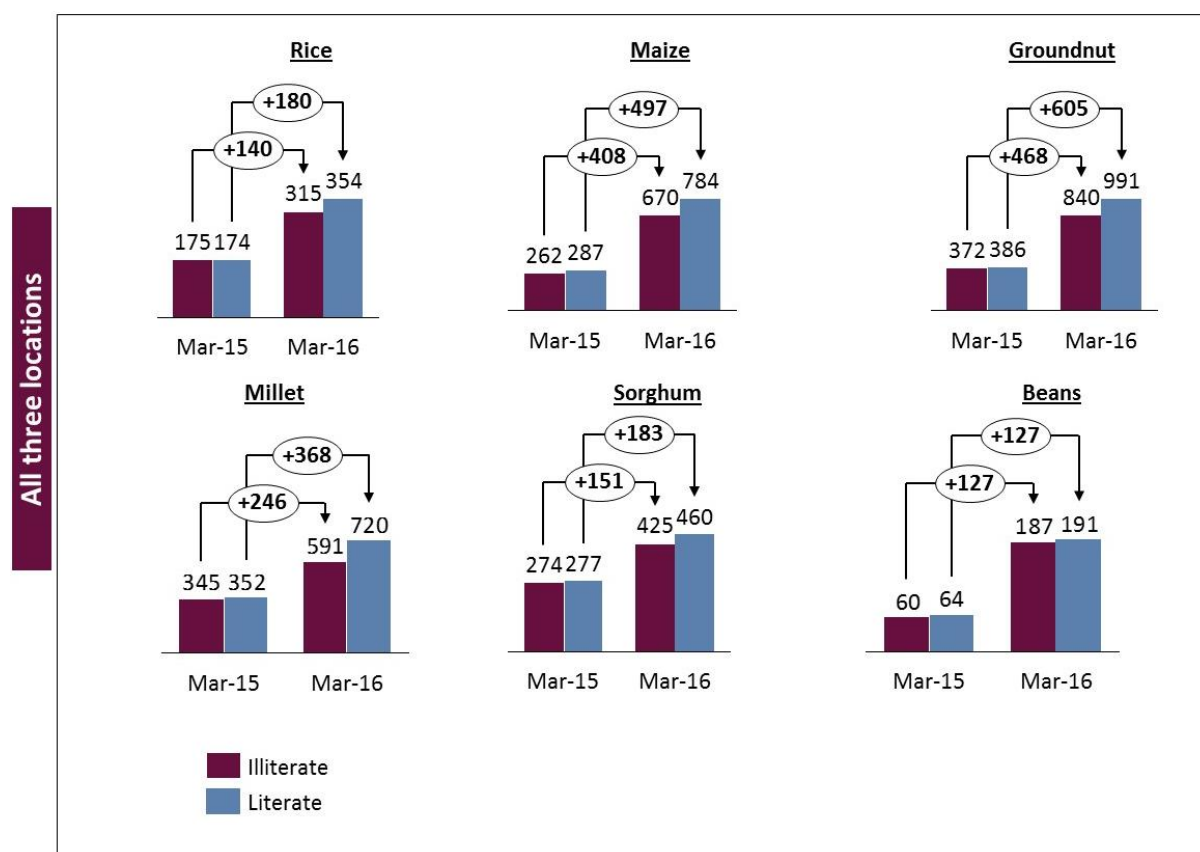
5.1 Analysis by characteristics of head of household

Summary: In this section, we compare the performance of program participants based on two characteristics of interest: the literacy and gender of the head of household. Households with **literate heads** generally report a higher increase in production compared to those with illiterate heads. This translates into a higher Food Consumption Score (FCS) and a greater reduction in the use of coping strategies. Monthly expenditure is also higher for houses with literate heads. In terms of **gender**, we find that increases in crop production are generally much higher for male-headed households. Male-headed households saw greater increases in production for four of the six main crops produced: (rice, maize, groundnut, millet). To make up for relatively low crop production, female-headed households spend a greater proportion of their income on food, leaving a smaller proportion available for other non-food needs and household assets. Accordingly, perception of poverty is higher among female-headed households.

a. Analysis by literacy of household head

For most of the major crops produced, households with literate heads report a greater increase in production compared to those with illiterate heads. For millet, the increase in production between 2015 and 2016 was 368 kg for literate heads compared to 246 kg for illiterates; for rice it was 180 kg for literates and 140 kg for illiterates; for maize, an increase of 497 kg for literates compared to 407 kg for illiterates; groundnut production increased by 605 kg for literates as opposed to 468 kg for illiterates; and for sorghum, the increase was 183 kg for literates as opposed to 151 kg for illiterates. Only one crop bucks this trend: for beans, both households headed by illiterates and literates experienced the same increases in production of 127 kg.

Figure 37: Average production volume of main crops by literacy of household head, kilograms



Text box 7: Relationship between farmer literacy and farm productivity

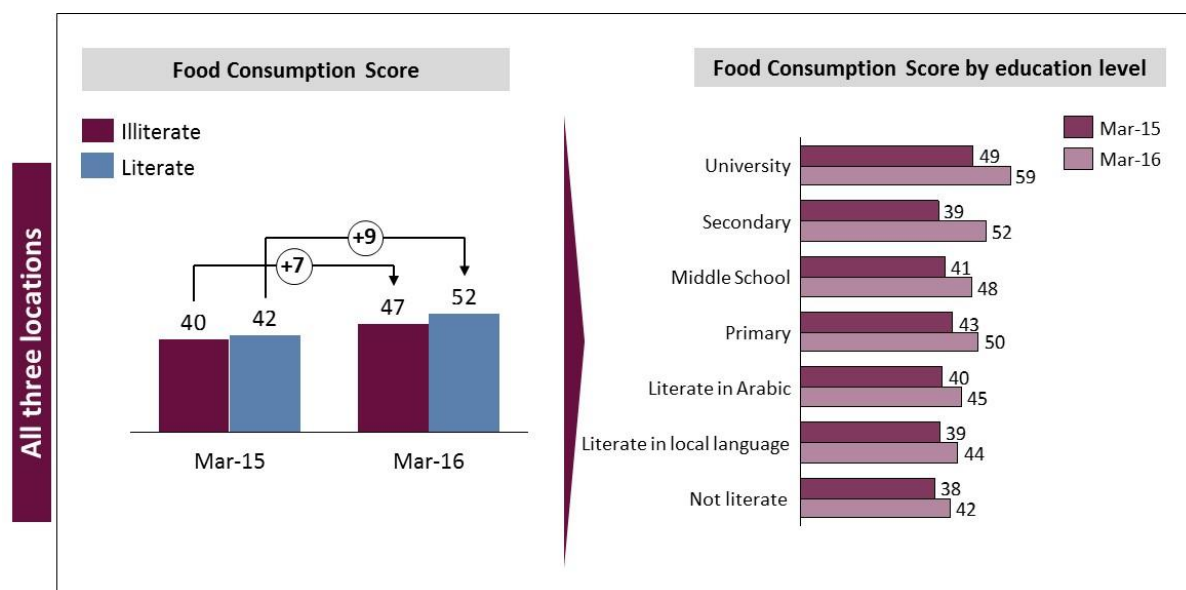
Several research studies have confirmed a link between education and farm productivity: better educated farmers serve as better managers, adopt more modern farm inputs, and prefer risky (high-return) production technologies. For example, a study in Ethiopia drawing on data from a large household survey revealed substantial private benefits of schooling for farmer productivity, particularly in terms of efficiency gains. The study, however, identifies a threshold effect: at least four years of primary schooling are required to have a significant effect upon farm productivity.²⁰ Another study in Bangladesh using a large dataset on rice producing households from 141 villages reveals that in addition to raising rice productivity and boosting potential output, household education significantly reduces inefficiencies.²¹

Mirroring the general trends in food production that favored participant households headed by literates, these households also experienced a greater increase in their FCS compared to households headed by illiterates. While households headed by literates experienced a nine-percentage-point increase in their FCS, those headed by illiterates experienced an increase of seven percentage points. When the level of literacy is further disaggregated, we see that the increase in the FCS experienced by households is generally proportional to the level of education of household heads. Participants with the highest levels of education have the largest increase in their FCS and those with the lowest levels report the smallest increase. This can be explained by the relatively smaller increases in production for households headed by illiterates.

²⁰ Weir Sharada, The Effects of Education on Farmer Productivity in Rural Ethiopia, Centre for the Study of African Economies Department of Economics, University of Oxford, March 1999.

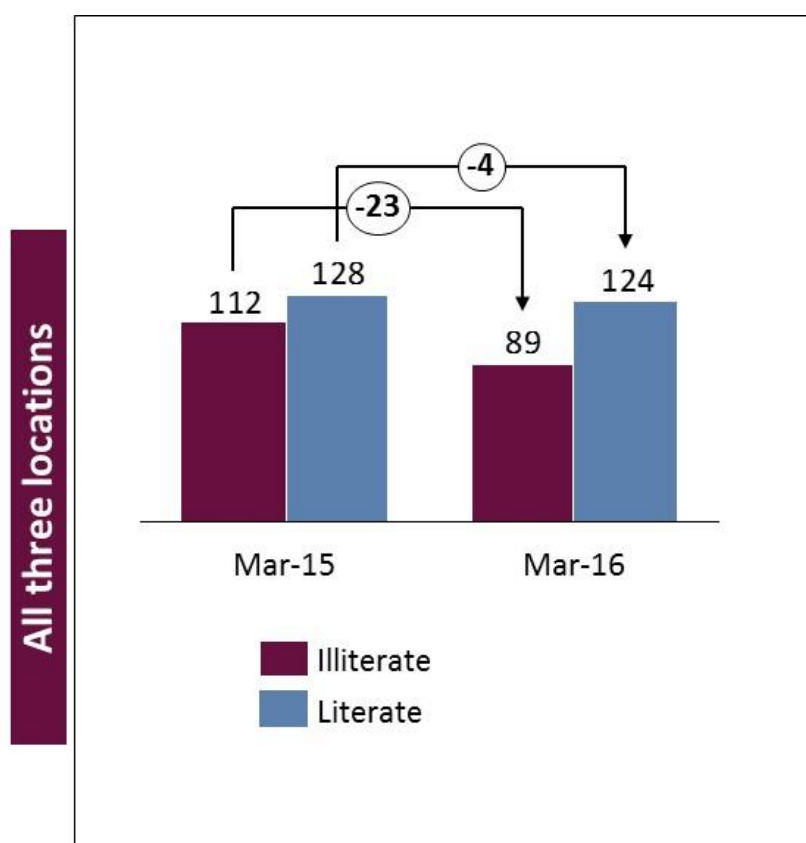
²¹ Niaz Asadullah, Farm productivity and efficiency in rural Bangladesh: The role of education revisited, SKOPE, Department of Economics, University of Oxford, Oxford, November 2005.

Figure 38: Food Consumption Score by literacy of household head



Furthermore, while both groups report a drop in average monthly expenditure, the decline was six times higher for households headed by someone illiterate. While households with literate heads reported a decline in average monthly expenditure of 4,000 CFA francs, those with illiterate heads reported a decline of 23,000 CFA francs. While both groups of households benefit from similar trainings from the program on how to engage in revenue-generating activities, it is possible that illiterates may require additional support in applying lessons on how to successfully implement these activities.

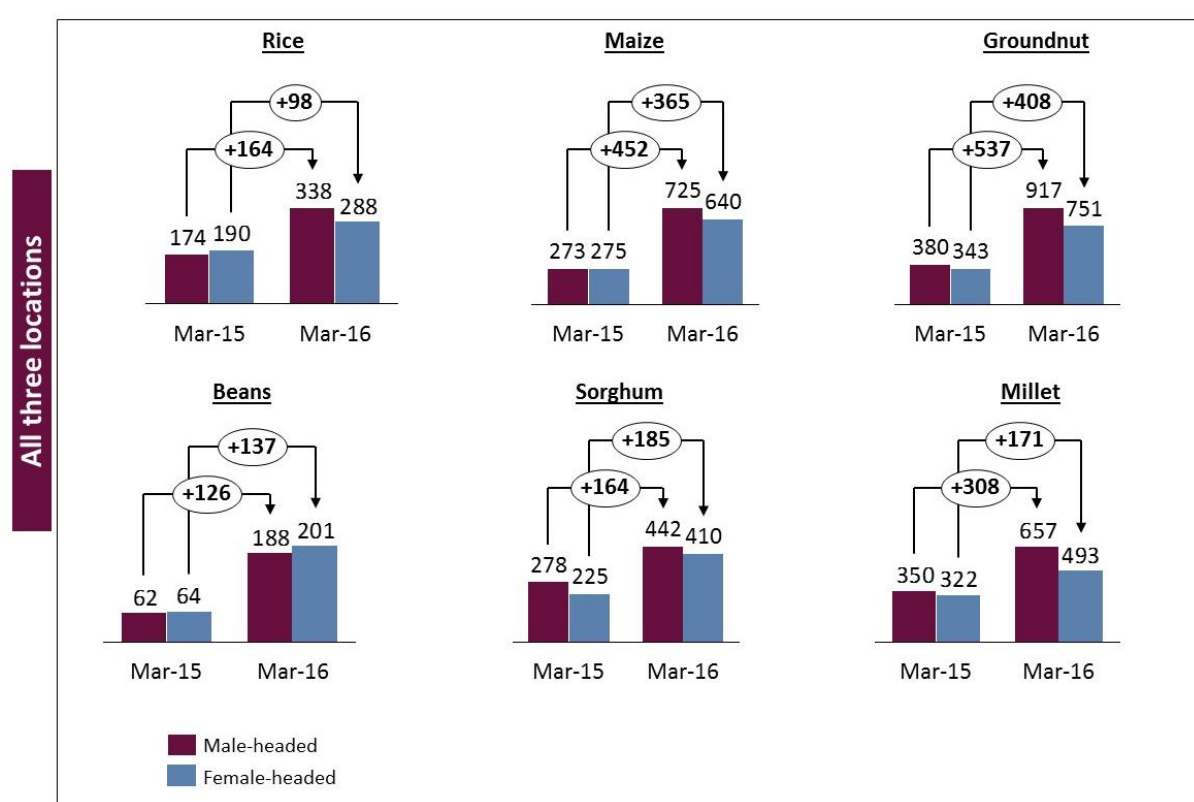
Figure 39: Average monthly expenditure (thousands of CFA francs)



b. Analysis by gender of household head

Increases in crop production are generally much higher for male-headed households. Male-headed households saw greater increases in production for four of the six main crops produced—rice, maize, groundnut, and millet—while households headed by women recorded greater increases in production of beans and sorghum (insights from locals suggest that production of these two crops has historically been dominated by women). This discrepancy could be partly explained by the gender biases against women in control over productive resources—including land, agriculture inputs, and equipment—which constrain women’s levels of agricultural productivity. A number of studies find that women would be as productive farmers as men if they were given access to similar resources. In other words, the ‘gender gaps in productivity’ would disappear in many cases, after controlling for input use, plot characteristics, labor use, and knowledge.²²

Figure 40: Average production volume of main crops by gender of household head, kilograms



Text box 8: Relationship between farmer gender and farm productivity

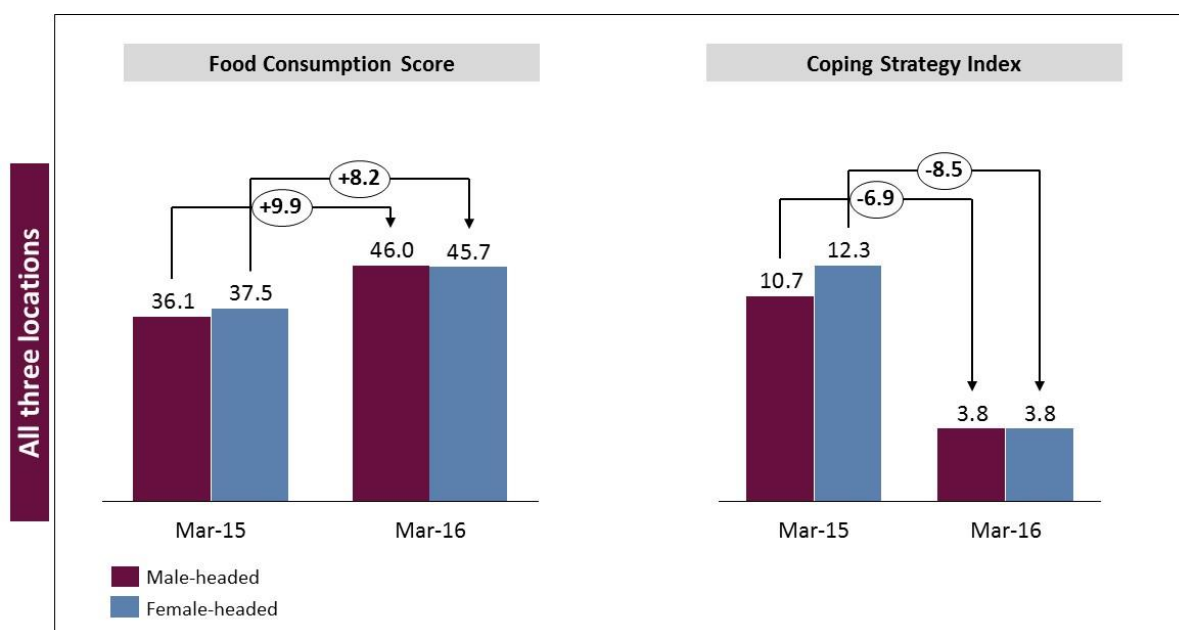
Several studies have assessed the productivity of male and female farmers. Overall, this research finds little or no significant difference in male and female agricultural productivity or technical efficiency after controlling for access to inputs and for characteristics of plots, households, and farmers. For example, Mook (1976) found statistically insignificant differences between men and women plot managers, after accounting for input use, farmer characteristics, and access to extension service. In Nigeria, Adeleke et al. (2008) compare the production functions for men and women maize farmers and find no significant difference in productivity after controlling for input use. A recent study by Hill and Vigneri (2011) on cocoa farmers in Ghana finds no gender gap in productivity after controlling for resource use (labor, fertilizer, insecticides, farm equipment), rainfall, and farm quality.

²² Cheryl Doss, “Women and Agricultural Productivity: What Does the Evidence Tell Us?” Yale University Economic Growth Center Discussion Paper No. 1051, October 2015.

These studies confirm that women farmers can be as productive as their male counterparts when given a level playing field. However, in practice, agricultural technologies and resources are not, in general, gender neutral. Women have smaller and often poorer-quality plots of land, affecting the scale of farming available to men and women. Access to markets may differ by gender; some markets are not understood as appropriate places for women, and the access to transportation may vary.²³

While male-headed households report a larger increase in food consumption, the drop in use of coping strategies is greater for female-headed households. Driven by higher production levels, households headed by males report a higher increase in FCS, though both groups are at similar levels in 2016. However, female-headed households reported a greater reduction in CSI.

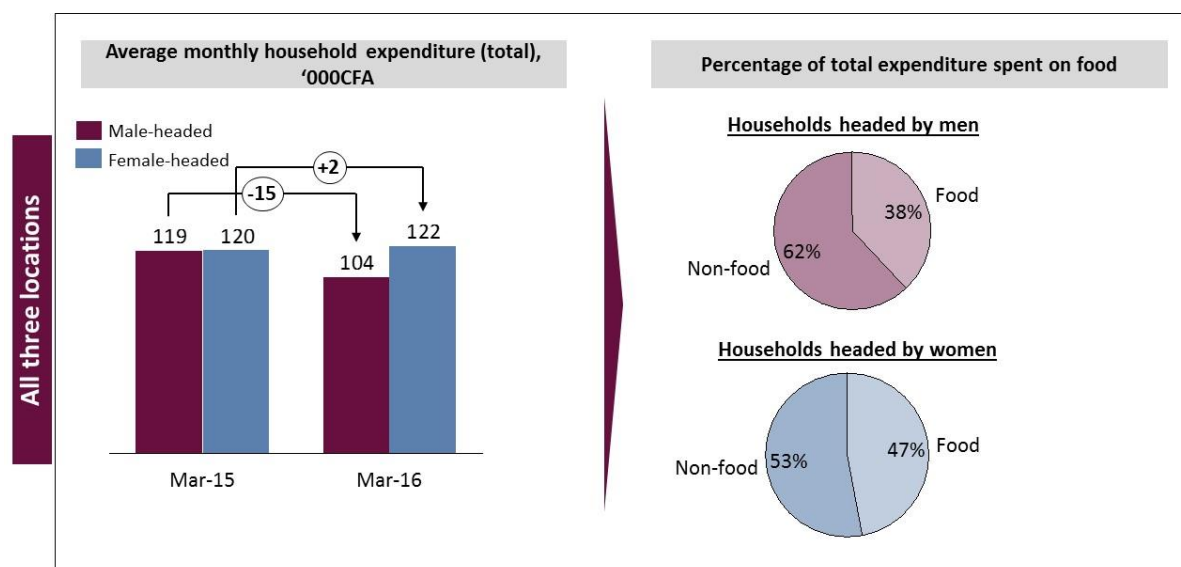
Figure 41: Food Consumption Score and Coping Strategy Index by gender of household head



The increase in average household expenditure is higher for households headed by women, with a higher proportion dedicated to food expenditure. Households headed by women reported an increase in average monthly expenditure of 2,000 CFA francs while those headed by males reported a reduction of 15,000 CFA francs. Accordingly, female-headed households spend more overall than do male-headed households. However, a breakdown of expenditures for these two groups indicates that female-headed households spend a greater proportion of their total income on food (47%) compared to 38% among male-headed households. Female-headed households may devote a higher proportion of expenditures to food in order to compensate for relatively lower levels of food production.

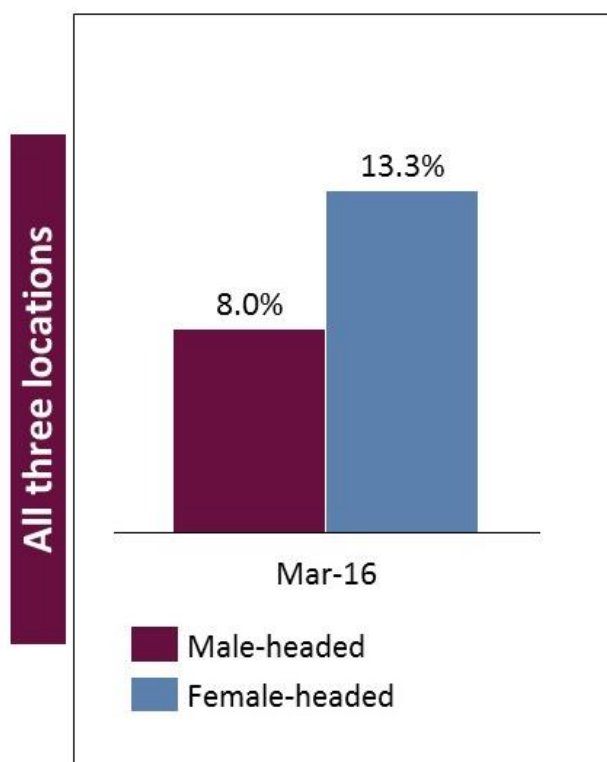
²³ Doss, 2015.

Figure 42: Average monthly expenditure by gender of household head



A higher percentage of households headed by women indicated that they are very poor relative to other households within their community. Among households headed by women, 13.3% identify themselves as being very poor relative to others within their community compared to 8% among households headed by men. Despite increased total expenditure among women-headed households relative to those headed by men, the proportion of expenditure that female-headed households spend on food increased from 28% in 2015 to 47% in 2016. This means a relatively smaller proportion was spent on other household needs, as well as assets, which may have contributed to their perception of poverty.

Figure 43: Percentage of households' that perceive themselves as very poor compared to others within the community

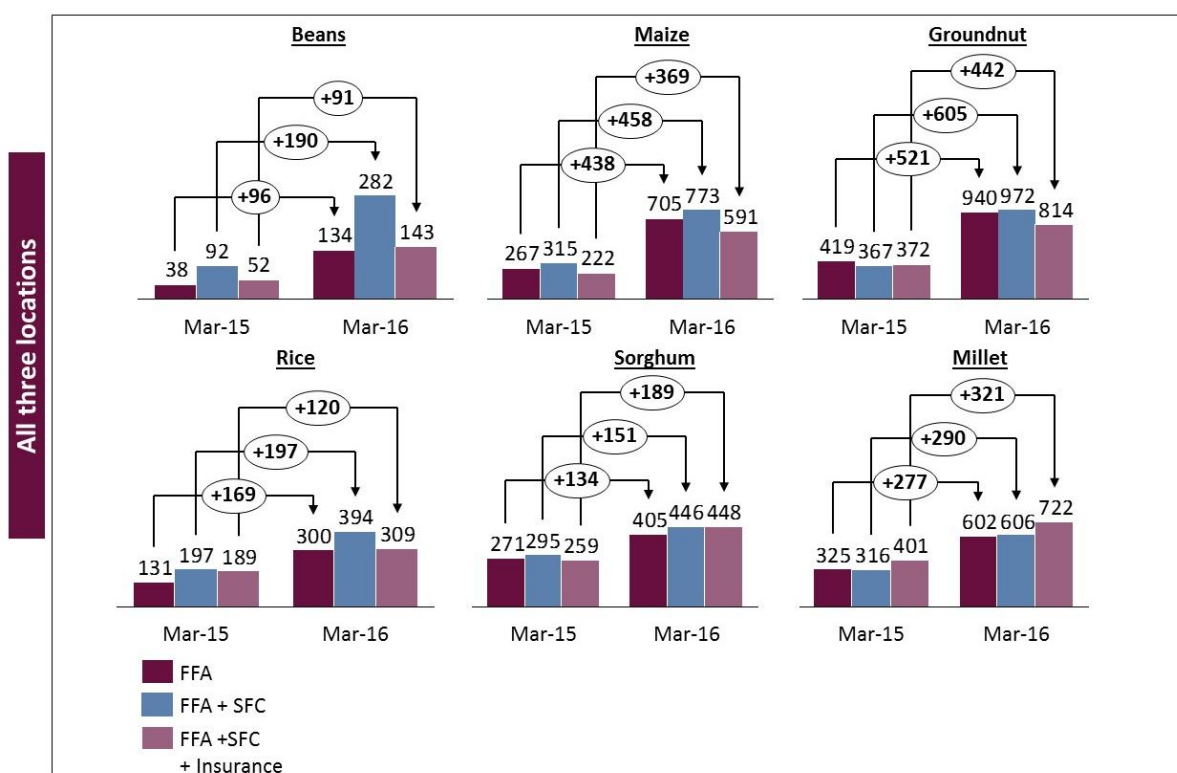


5.2 Analysis by categories of intervention groups

In this section, we compare performance on key indicators across the three sub-groups of participants: FFA, FFA + SFC, FFA + SFC + insurance.

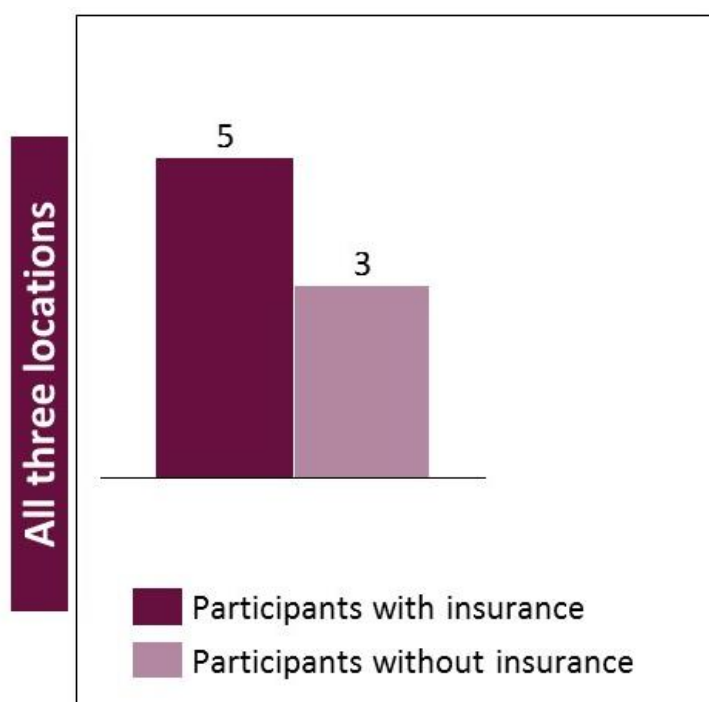
A comparison of production increases across the three intervention groups indicates that participants benefiting from a combination of FFA and SFC reported the greatest increase in the four main crops produced. These crops include rice, maize, groundnut, and beans. For beans, the increase in production for FFA + SFC was almost double that of the two other groups. Participants that received FFA + SFC + insurance also experience greater increases in two other crops: sorghum and millet. These trends generally suggest that a combination of FFA with other interventions (either SFC, insurance, or both) leads to greater increases in production. In the case of SFC, participants are able to save money and take out small loans, enabling them to make investments in their crop production.

Figure 44: Average production volume of main crops by participant sub-groups, kilograms



As expected, households with insurance spent more on average on agriculture inputs than those without insurance. Our assumption is that farmers feel more confident investing in agricultural inputs when protected by insurance against loss. Sustaining these investments over time should translate into higher production. Analysis of average monthly spending on agriculture investments (including farm inputs and equipment) indicates that households that carry insurance spent on average 5,000 CFA francs compared to 3,000 CFA francs for households without insurance. Having insurance enabled households to increase their agriculture investments with the assurance that, in the event of poor rainfall, their investments would not completely be wasted, as they would still receive some compensation. Sustaining these levels of investments and increasing household expenditure on agriculture inputs will hopefully translate into better outputs.

Figure 45: Average monthly expenditure on agriculture (thousands of CFA francs)



Text box 9: R4's weather-index insurance product

R4's weather-index insurance is a financial product based on rainfall index highly correlated to local yields. Payouts are triggered by pre-specified patterns of the index rather than actual yields, thus eliminating the need for in-field assessment. Compensation for weather-related losses means farmers can avoid selling productive assets and recover faster from droughts. Predictable income can reduce negative coping strategies and encourage rural households to invest in activities and technologies with higher rates of return. In 2015, a total of 3,621 farmers in Tambacounda and Kolda assessed the weather-index insurance product out of which 3,388 paid for the insurance premiums by working additional days through the Insurance for Assets scheme and the remaining 233 farmers through a partnership with the International Fund for Agricultural Development (IFAD) as part of the *Programme d'Appui au Développement Agricole et à l'Entreprenariat Rural (PADAER)* Initiative. Total premium amounted to US\$87,103 (52,697,146 CFA francs) and the total sum insured amounted to US\$592,888 (358,697,465 CFA francs).

In early 2016, more than 3,334 insured farmers received a payout compensation for the losses suffered during the 2015 agriculture season, due to a long dry spell. The distribution of payout to farmers was done during a ceremony in March 2016 in the village of Medina Diakha in Tambacounda region in the presence of local authorities, implementing partners, local communities, and WFP's Director ad interim and staff. Total payouts received by insured farmers amounted to US\$80,969 (48,985,951 CFA francs).

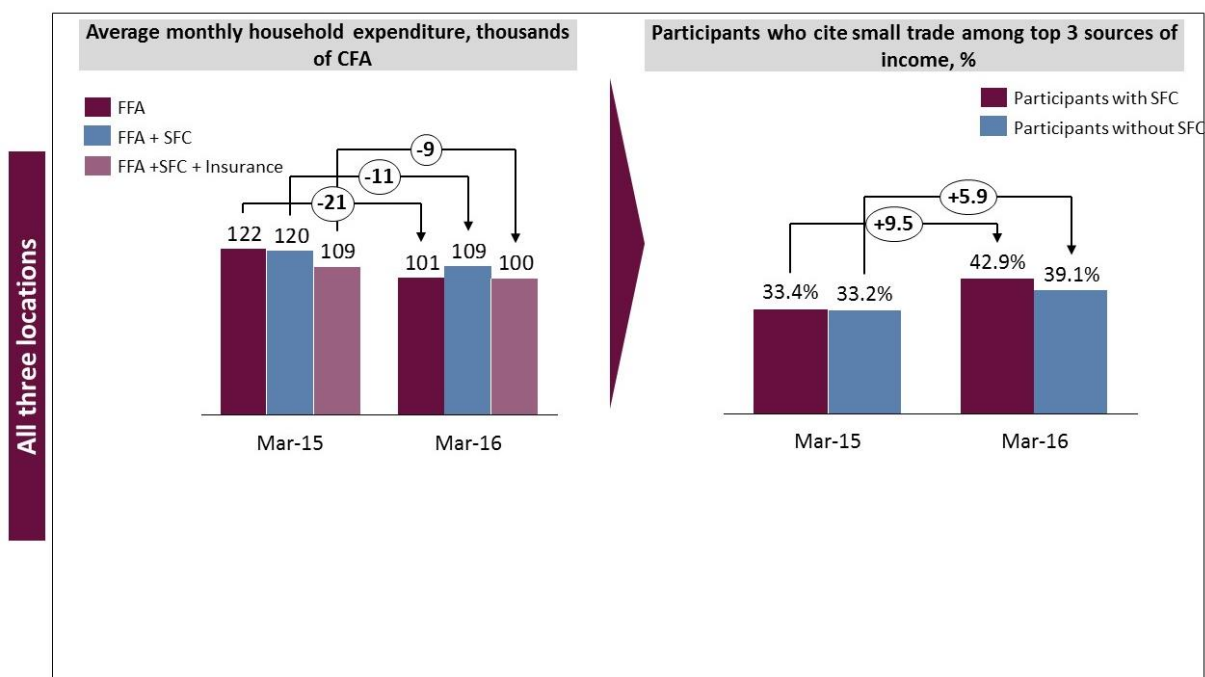


A subscriber to the R4 weather insurance shows the insurance contract to receive her payout in Medina Diakha village, Tambacounda

Photo: Carla De Gregorio, March 2016

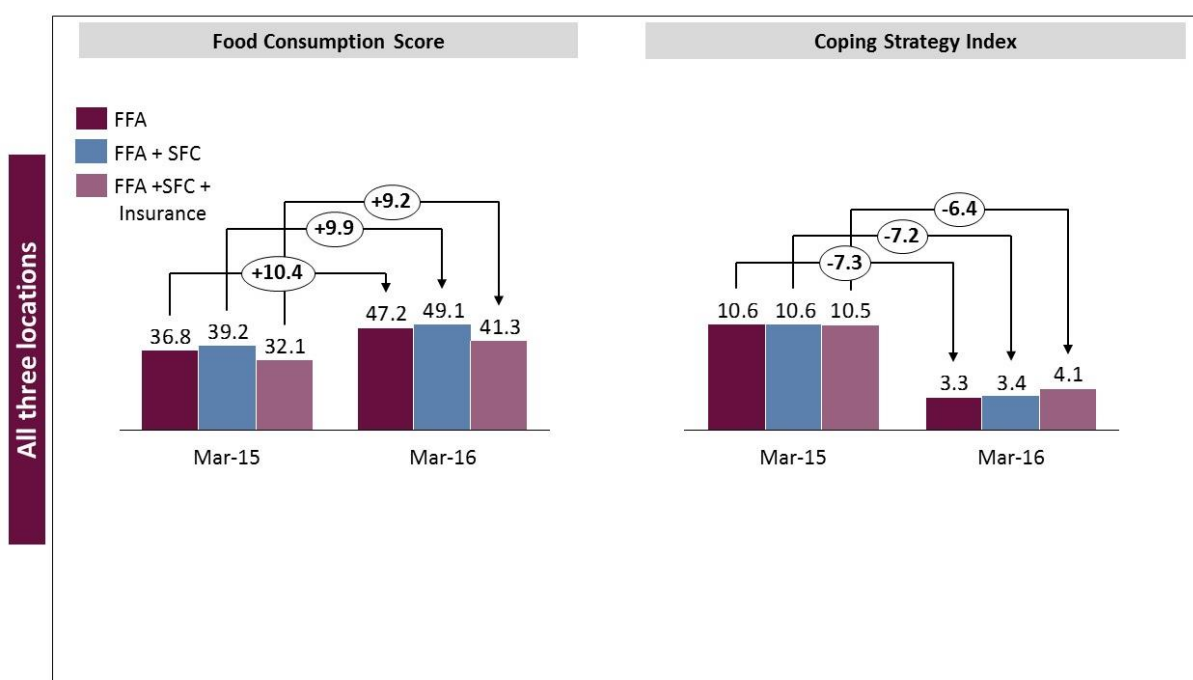
Participants whose interventions included a SFC component report a lower reduction in total household expenditure. FFA-only participants reported a reduction in average monthly expenditure of 21,000 CFA francs compared to a reduction of 10,000 CFA francs for participants in both FFA + SFC and FFA + SFC and insurance. This suggests that the SFC component bolstered household expenditure by supporting households in generating revenue through activities such as small trade. For example, program participants with SFC saw an increase of 9.5 percentage points in the proportion of households that cite small trade among their top three sources of income; meanwhile, participants without SFC (i.e., FFA-only participants) saw an increase of just 5.9 percentage points. Expanding SFC to more households could provide households with additional revenue sources, enabling an increase in non-food expenditure and acquisition of assets.

Figure 46: Average monthly expenditure, thousands of CFA francs; small business as a source of income



The FCS and CSI are similar for the three groups, with FFA-only participants reporting a slightly higher performance. FFA-only participants experienced an increase in FCS of 10.4 points, compared to 9.9 for FFA + SFC and 9.2 for FFA + SFC + insurance. For CSI, FFA-only participants experienced a reduction of 7.3 points, compared to 7.2 points for FFA + SFC and 6.45 for FFA + SFC + insurance. The data indicate that the FFA component is essential in boosting the food security of households through food assistance and the development of community assets that enhance food production.

Figure 47: Food Consumption Score and Coping Strategy Index for participants by intervention groups



6 Lessons learned and recommendations on the way forward

Based on the findings presented in the preceding sections on the program's impact as well as the drivers of performance, the section below focuses on distilling key lessons to inform project design and programming going forward.

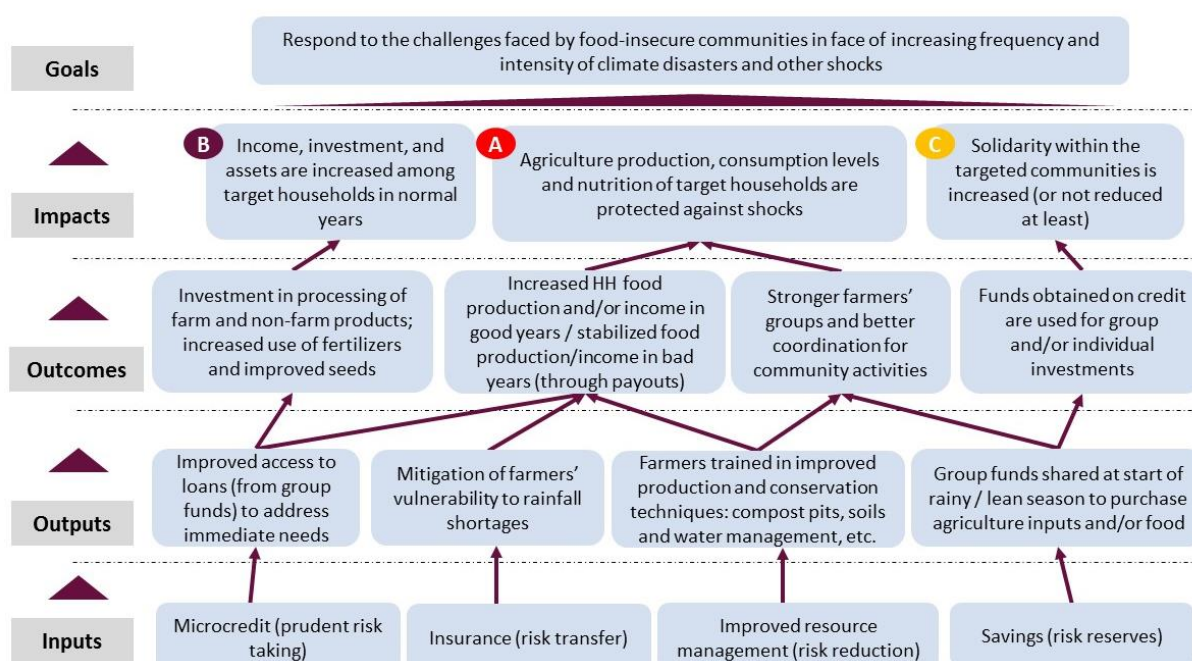
6.1 R4's theory of change as a point of departure to analyze program performance

R4's theory of change is anchored on:

- Ensuring that households' agriculture production, consumption and nutrition levels are protected against shocks. The R4 program helps communities reduce the distress of shocks by mobilizing households to develop lowlands for rice cultivation, providing training and implementing improved water management techniques on farms, supporting households in cultivating vegetable gardens, providing food assistance to households for their participation in building community assets, and enrolling households in a weather-index crop insurance product.
- Increasing income, investments, and assets among target households in normal years. R4's group savings scheme, provision of credit for income-generating activities, and training on financial management and strategies to effectively manage income-generating activities support this goal.
- Improving solidarity within communities involves implementing the program's activities across the two other goals described above in a manner that strengthens community solidarity. Improved community solidarity or social capital is the foundation for community-level resilience, which is determined by a community's capacity for collective action as well as its ability to solve problems and build consensus to negotiate coordinated responses to shocks. A community-level focus on resilience is expected to result in local participation, ownership, and flexibility in building resilience.²⁴ R4 supports this goal through undertaking joint community work to build assets, creating savings groups, and forming economic interest groups to undertake income-generating activities in groups.

²⁴ Frankenberger, T. et al., "Community Resilience: Conceptual Framework and Measurement – Feed the Future Learning Agenda," USAID, October 2013.

Figure 48: R4 program theory of change



Source: TOC from WFP/AO; TORs - Impact Evaluation Study of the R4 Rural Resilience Initiative in Senegal; Dalberg analysis

To achieve each of the program's impact goals, the R4 program undertook a number of activities that are described in the table below, along with the core indicators to measure program performance.

Core R4 program impact goals, activities, and indicators

IMPACT GOAL	CORE ACTIVITIES UNDERTAKEN	CORE INDICATORS
Goal A: Household agriculture production, consumption levels and nutrition are protected against shocks	<ul style="list-style-type: none"> Mobilized households to develop lowland sites for rice production, including treating soils with fertilizer, compost pit making, and constructing stone bunds and dikes to improve water management Developed lands for cultivation of vegetable gardens Provided households with improved rice and vegetable seeds Trained farmers in improved production and conservation techniques Provided food assistance to households in return for participation in building community assets Enrolled households on a weather-index-based insurance product 	<ul style="list-style-type: none"> Food Consumption Score Coping Strategy Index Volume of crop production for rice, vegetables, and other crops
Goal B:	<ul style="list-style-type: none"> Organized small savings groups to grow households savings and provide access to small loans for productive investments 	<ul style="list-style-type: none"> Household expenditure

IMPACT GOAL	CORE ACTIVITIES UNDERTAKEN	CORE INDICATORS
Income, investment, and assets are increased among target households in normal years	<ul style="list-style-type: none"> Organized more established savings groups into economic interest groups to undertake joint income-generating activities Set up a revolving credit facility through a microfinance institution to provide loans to economic interest groups for income generating activities Trained households on financial management and strategies for managing income-generating activities Enrolled households in a weather-indexed insurance product to encourage agriculture investments 	
Goal C: Solidarity within the targeted communities is increased	<ul style="list-style-type: none"> Activities, described above, to enhance household food security and increase income and investments were undertaken within community groups 	<ul style="list-style-type: none"> Head of household perception of truthfulness and helpfulness of others Community support systems—to whom households will turn during difficult times

6.2 Lessons learned on R4 program performance on key impact goals

a. Impact goal A: Protecting household agriculture production, consumption, and nutrition against shocks

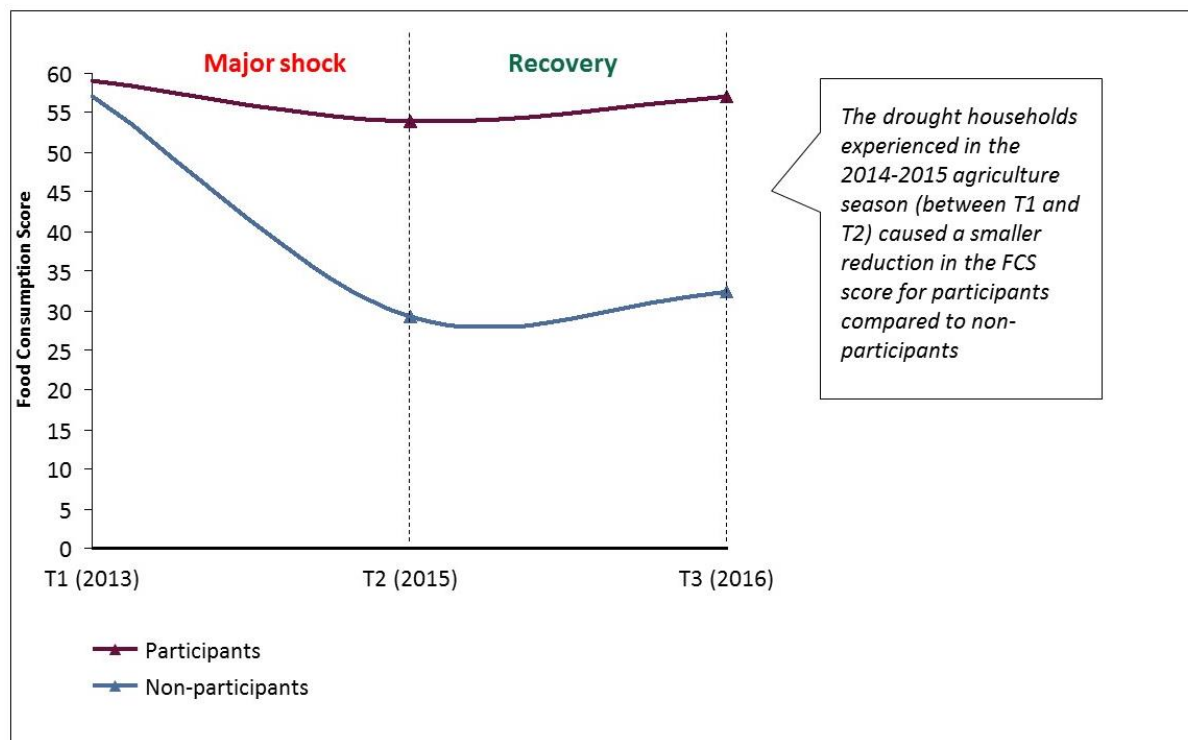
The program has demonstrated strong results in reducing the adverse impact of shocks on the food security of participant households. A comparison of the Food Consumption Score (FCS) and Coping Strategy Index (CSI) of participants and non-participants between 2013 and 2015 in Koussanar reveals that participants coped better with the drought during the 2014–2015 agriculture season, as described in section 3.²⁵

FCS trends demonstrate that the R4 program reduced the adverse impact of the 2014-2015 drought on the food consumption of participant households. As shown in Figure 49, both participants and non-participants in Koussanar experienced a reduction in their FCS between T1 (2013) and T2 (2015)—that is, during the drought. However, the decrease was much larger for non-participants compared to

²⁵ Households in Tambacounda and Kolda are excluded from this analysis because the program commenced in both locations after the period of drought.

program participants. The FCS of non-participants decreased by 27.7 points, from 57.0 in 2013 to 29.3 points in 2015, while the FCS of program participants decreased by 5.1 points, from 59 in 2013 to 53.9 points in 2015.

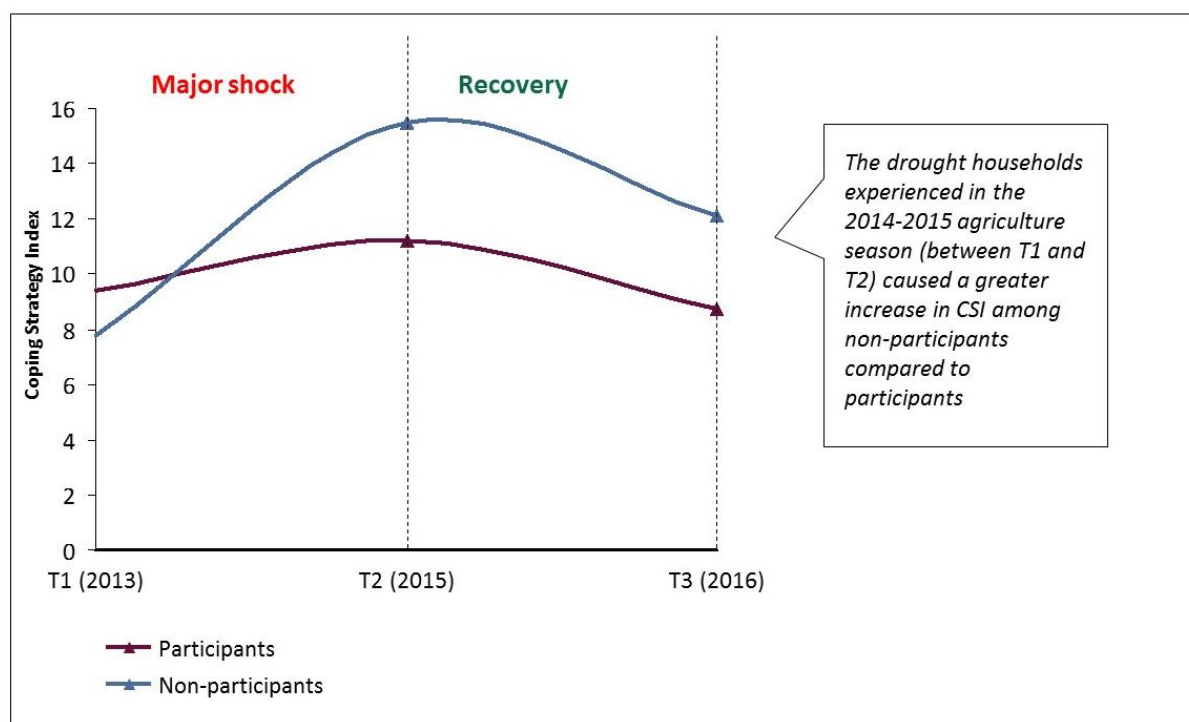
Figure 49: FCS trends among participants and non-participants in Koussanar



Our analysis also shows that, relative to non-participants, program participants experienced a relatively small rise in their CSI, a further confirmation that the program enabled participants to cope better with the shock of the 2014-2015 drought.²⁶ As Figure 50 illustrates, while both groups experienced an increase in their CSI between T1 and T2, the rise was much greater among non-participants: an increase of 7.8—from 7.7 in 2013 to 15.5 in 2015—for non-participants, compared to an increase of 1.8—from 9.4 in 2013 to 11.2 in 2015—for participants. This discrepancy suggests that the 2014-2015 drought had a more profoundly adverse impact on the food security of non-participants, forcing them to increase their use of various coping strategies.

²⁶ An increase in coping strategy is a negative development as it signals the increased use of measures such as consuming cheaper but less preferable foods, borrowing food, decreasing the amount of food consumed, or buying more food on credit than usual.

Figure 50: CSI trends among participants and non-participants in Koussanar

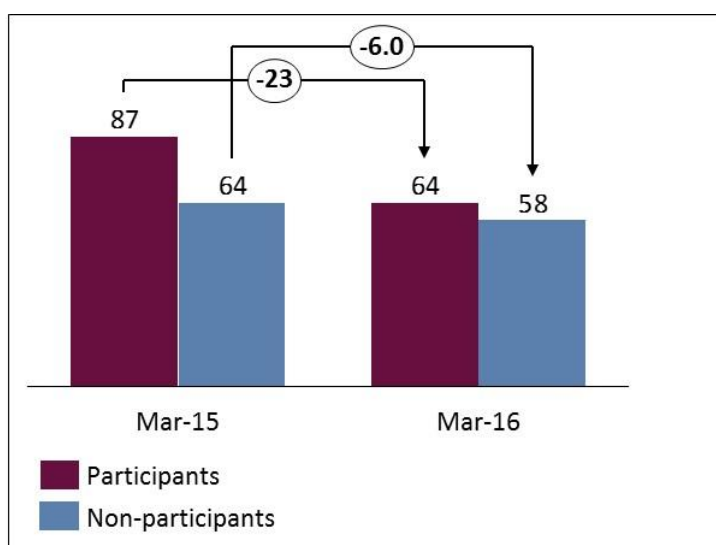


b. Impact goal B: Increasing household income, assets, and investments in normal times

To measure progress toward this goal, we compare the performance of participants and non-participant households based on average household non-food expenditure.

Between T2 (2015) and T3 (2016), the decline in average monthly household non-food expenditure was greater among program participants (see Figure below). Program participants experienced an average decline of 23,000 CFA francs in monthly household non-food expenditure while non-participants experienced a decline of 6,000 CFA francs over the same period. The absolute value of average monthly non-food expenditure for participants (64,000 CFA francs) is still higher than non-participants (58,000 CFA francs).

Figure 51: Average household non-food expenditure during last 30 days (thousands of CFA francs)

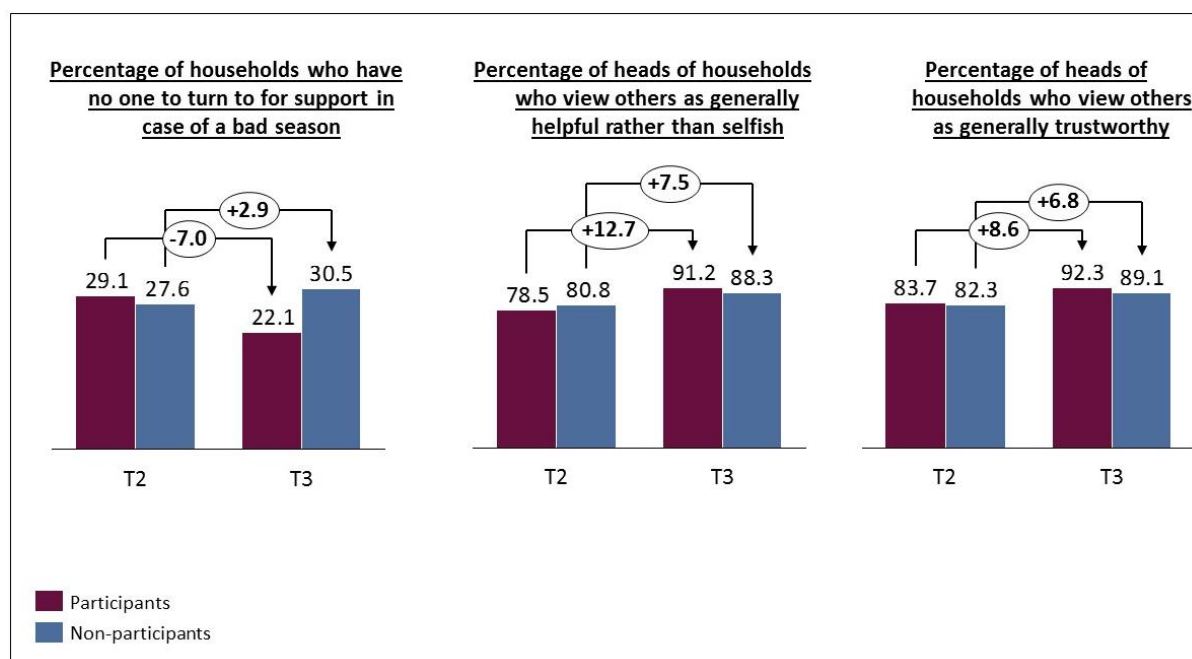


It is likely that program participants reduced their expenditure and asset acquisition, to be able to save, invest in revenue-generating activities and invest in livestock. These investments will start showing some returns in the medium to longer term, to be able to significantly impact participant AOS and other expenditures.

c. Impact goal C: Increasing solidarity within targeted communities

The program has strengthened social bonds among program participants, as demonstrated by the more favorable evolution in perceptions of trust and helpfulness among program participants compared to non-participants. Figure 52 shows that while the percentage of non-participants who indicated that they have no one to turn to in case of a bad season increased from 27.6% to 30.5% between 2015 and 2016, that of participants decreased from 29.1% to 22.1% over the same period. Additionally, increases in the percentage of program participants who view others as generally trustworthy and helpful is greater than that of non-participants. This suggests that the communal approach adopted in implementing the program's main activities—such as undertaking joint community work to build assets, creating savings groups, and forming economic interest groups to undertake income-generating activities in groups—has contributed to strengthening social bonds among program participants.

Figure 52: Comparison between program participants and non-participants on indicators of solidarity



6.3 Recommendations

Drawing on the analysis presented above, we offer the following recommendations on how to bolster the R4 program's progress toward achieving its impact goals.

- a. Recommendations on further assessments of the effects of investments by participant households:
 - Undertake in 2017 a follow-up study of indicators of income, assets, and investments in order to assess the impact of savings, investments in revenue-generating activities and

increased cattle ownership. A follow-up study in 2017 will extend the period of observation, allowing WFP and Oxfam to assess if program participants experience an upward swing across indicators of household expenditure and income—or if, instead, the trend remains unchanged. Additionally, the study should analyze the factors that influence households' expenditure and investment decisions, including which assets they consider important in strengthening their own resilience.

b. Recommendations to deepen the program's impact in protecting household agriculture production, consumption, and nutrition against shocks:

- **Provide targeted support to households headed by illiterates and females to minimize the effect of shocks on their food security and to speed up their recovery.** As indicated in the analysis, among program participants, households headed by illiterates performed below those headed by literates on volume of staple crop production, FCS, CSI, and household expenditure. Additionally, households headed by women experienced lower increases in production of staple crops, likely an indication of the systemic biases in agriculture production, such as access to land, inputs, and equipment. This suggests that the program can deepen its impact by developing targeted interventions to support households headed by illiterates and women. The program can consider introducing a literacy component to help illiterate participants to acquire basic skills that will enable them to better benefit from the program's activities. For female-headed households, in addition to helping women to cultivate vegetables and supporting lowlands rice production, the program can consider working with local institutions toward removing barriers that women face in agriculture production, such as limited access to land and agriculture inputs. Additionally, the program should integrate the SFC methodology into the other intervention groups given its strong role in supporting women in undertaking income-generating activities.
- **Expand support for agriculture production to address other stresses that inhibit productivity; further protect households' food security against shocks.** While the program's support for rice and vegetable cultivation—through the provision of inputs and the implementation of improved water management techniques—has enabled households to increase their production, other ongoing stresses continue to limit their attainment of higher yields. In particular, households indicate that insect invasion of their vegetable gardens and the destruction of crops by freely grazing livestock due to poor fencing on farms are threats to their agricultural activities. Additionally, the lack of agricultural equipment is a challenge for crop production. Some participants also indicated that they received seeds and fertilizer from the program too late in the last agriculture season. Addressing these challenges will improve production and strengthen households' buffer against shocks to food security.

c. Recommendations to improve program performance in increasing household income, assets, and investments in normal times

- **Expand and deepen support for households undertaking income-generating activities that can help place them on a positive income trajectory post shocks.** The strong reliance of households on agriculture as their main source of livelihood makes crop production a good starting point for activities aimed at improving household incomes. However, as indicated earlier in the analysis, despite the fact that participant households improved their staple crops production, the proportion of output they were able to sell remained limited. In addition to continuing to help households achieve further increases in their

yields (in order to ensure that they have a surplus to sell after accounting for their own consumption), the program can initiate a number of targeted measures to incentivize commercialization. Some potential interventions include the following:

- *Organizing and supporting collective selling* – Training and strengthening the capacity of participants to find buyers and increase their bargaining power when negotiating for better prices
 - *Training farmers on quality management and marketing* – Training farmers on post-harvest handling techniques to improve quality of produce, reduce post-harvest losses, and enable farmers to meet the quality requirements of buyers
 - *Linking participants with market information systems* – Providing farmers with information on market prices to bridge information asymmetries between farmers and buyers
 - *Linking farmers / farmer groups to top-of-supply-chain buyers* – Facilitating linkages between farmers and private and institutional off-takers through direct contracting
 - *Providing processing and storage facilities* – Providing physical infrastructure for storage to reduce post-harvest losses and help farmers to store produce and sell it later when prices are higher.
 - *Expanding the number of participants covered by revolving credit schemes to undertake income-generating activities* – The specific income-generating activities that the project supports should be tailored to the needs, resource endowments, and opportunities within the communities in question. For example, in addition to initiatives already being supported by the program, participants from focus group discussions have highlighted a range of opportunities for income-generating activities, including producing and selling honey, processing cashew nuts, producing soaps, dyeing fabrics, and producing couscous from the baobab fruit.
- **More fully integrate the program’s various components in order to leverage the respective strengths of each component toward increasing resilience before, during, and after shocks.** For example, the SFC methodology, including savings and credit, bolstered household expenditure by helping households engage in revenue-generating activities such as small trade. FFA is also essential to bolstering the food security of households through food assistance and the development of community assets that enhance crop production. Insurance also provides protection to households during periods of bad harvest, and incentivizes households to increase their investments in agricultural production. The three interventions should continue to be provided as an integrated package to support participants in a holistic manner and strengthen the resilience of households.
 - **Increase awareness of the benefits of insurance for securing households’ productive investments, minimizing the impact of shocks, and strengthening the ability of households to rebound.** There is evidence from the evaluation data that beneficiaries of insurance are already investing more in agriculture—their average monthly expenditure on agricultural inputs is higher than that of other participants who do not benefit from insurance. Increased awareness of how insurance works as well as prompt payments of claims will increase the confidence of farmers in the product and encourage even greater agricultural investments. This, in turn, can lead to increased crop production to meet the nutritional and income needs of households.

7 Appendix

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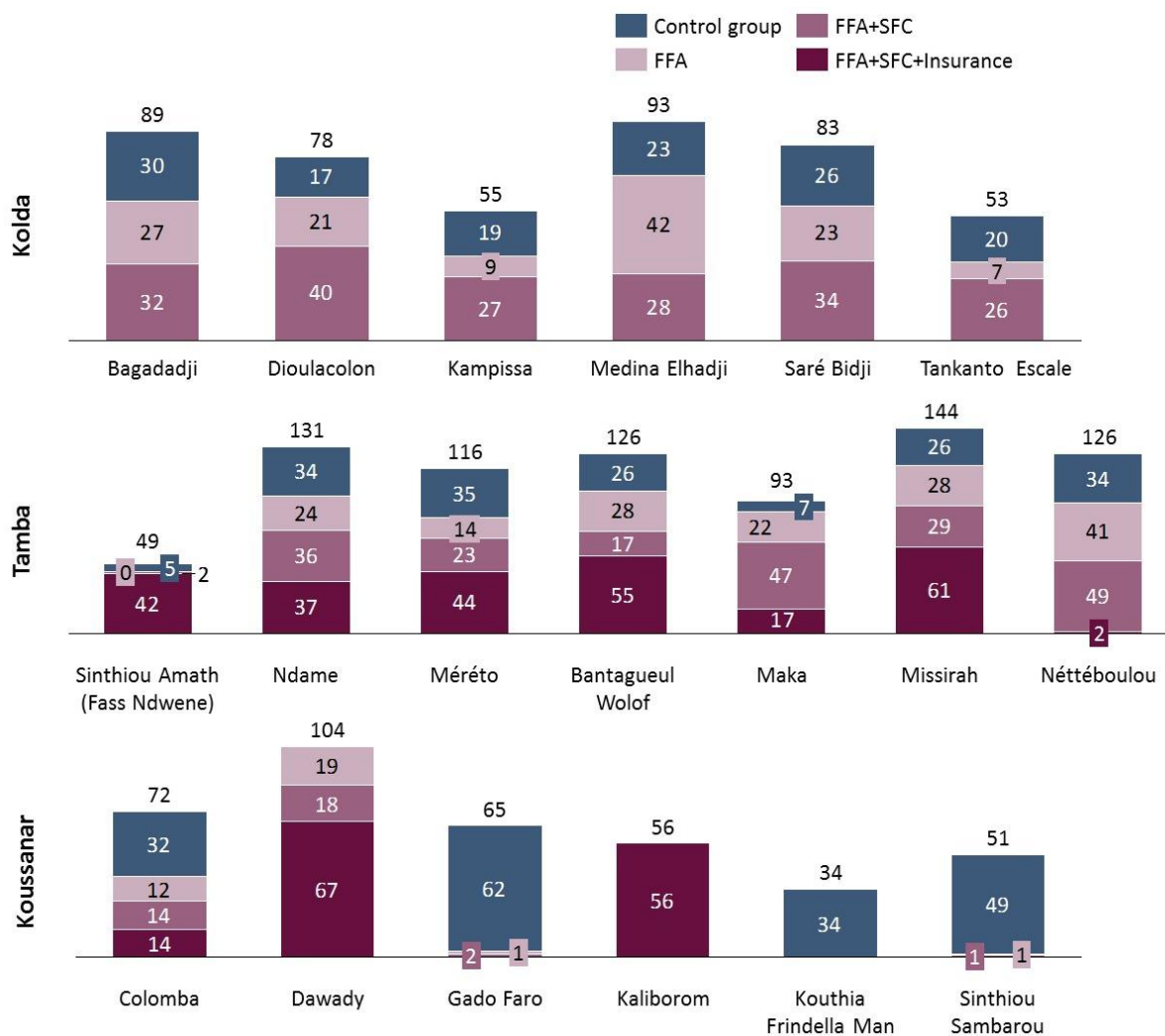
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7.2 Samples across clusters

Figure 53: Survey sample distribution across locations

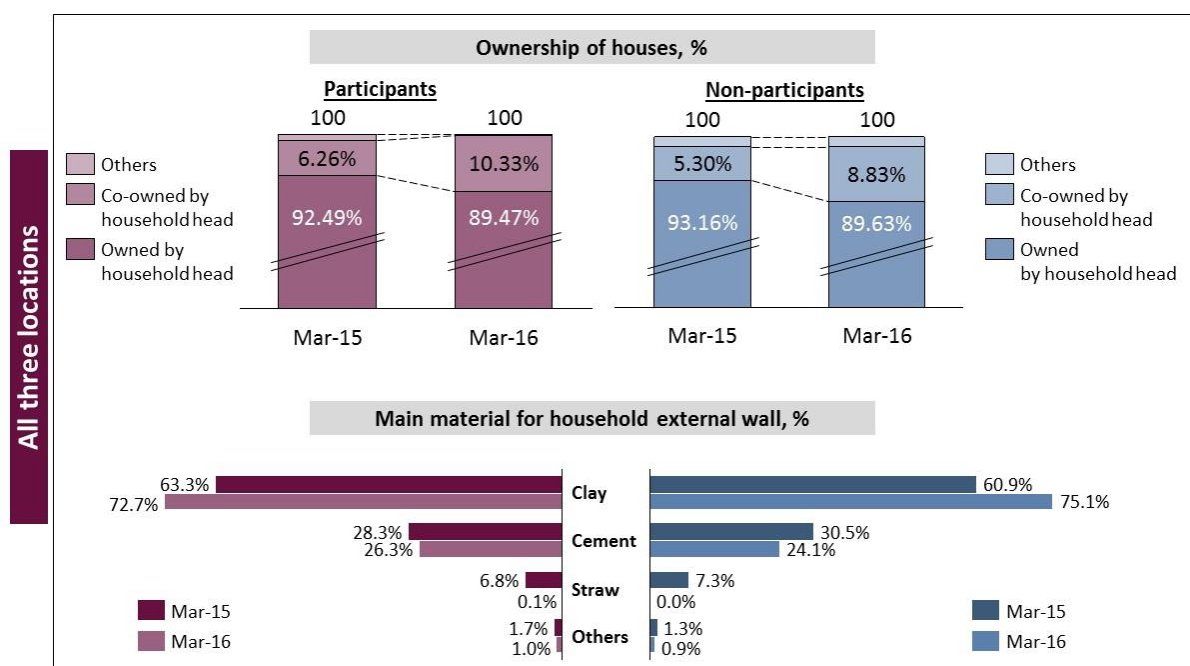


7.3 Additional description on household characteristics

Across all locations, the percentage of households that own the houses they live in decreased for both participants and non-participants, with a corresponding increase in co-ownership of homes. For participants, the percentage of households that owned their homes decreased from 92.5% in 2015 to 89.5% in 2016. For non-participants, this figure decreased from 93.2% in 2015 to 89.6% in 2016. However, an analysis of home ownership across each of the three locations indicates that in Kolda, the percentage of households that own their own homes increased for both participants and non-participants. On the other hand, the home ownership rate decreased for both groups in Tambacounda. In Koussanar, between 2013 and 2015, home ownership remained fairly steady for both groups, but declined in 2016.

Both participants and non-participants report that an increased proportion of the external walls of their households are made of clay relative to other materials such as cement and straw. Across all three locations, the proportion of households constructed from clay increased from 63.3% in 2015 to 72.7% in 2016 for participants and 60.9% to 75.1% for non-participants. Accordingly, there was also a reduction in the usage of cement blocks, straw, and other materials. Increased use of clay as a building material in the 2015-2016 season is likely due to high rainfall levels, which increased the availability of clay, thereby reducing its cost relative to other construction materials and leading families to replace deteriorating houses with those made from clay.

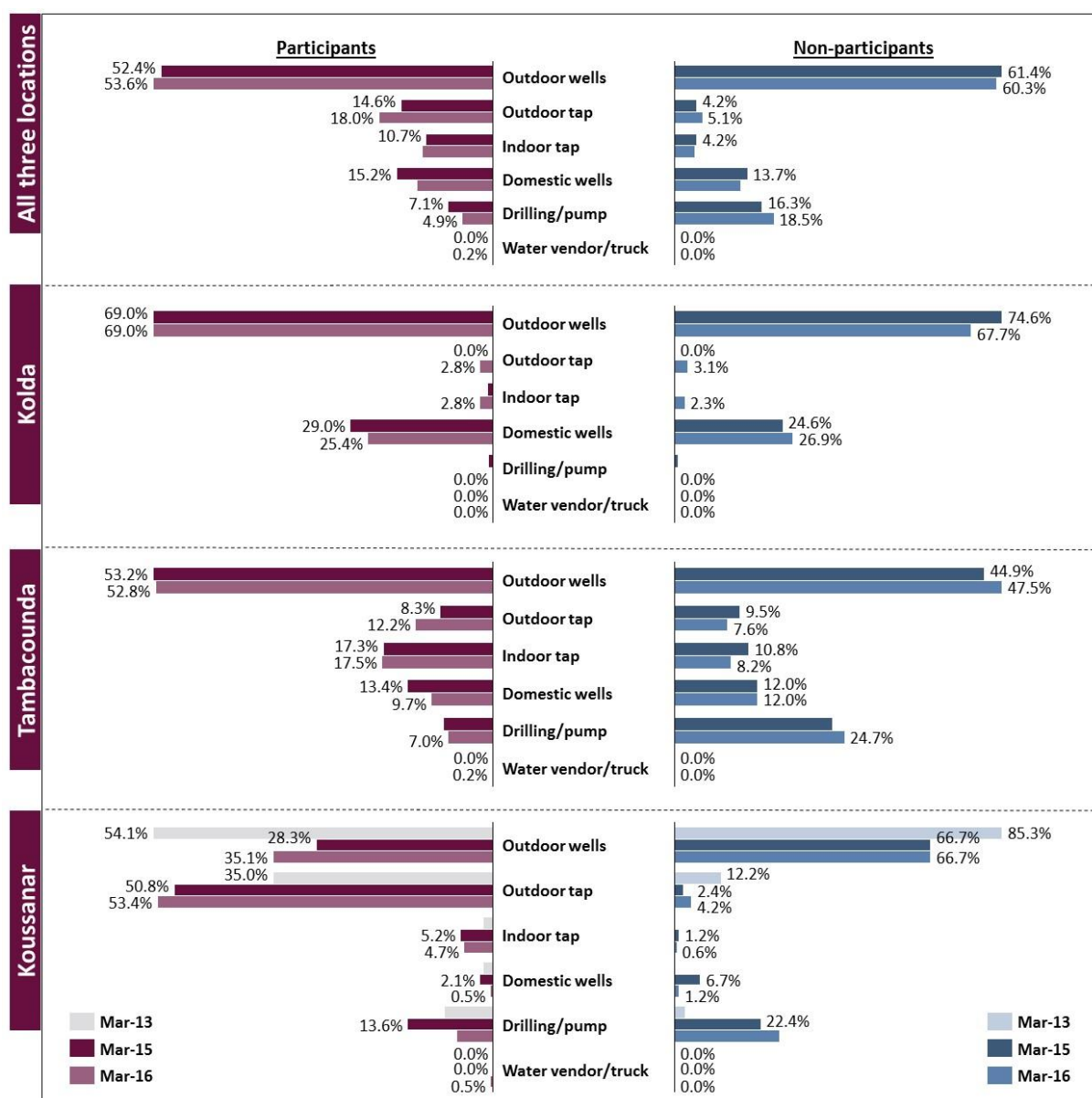
Figure 54: House ownership and material for construction of external walls



Across all three locations, the majority of households—both participants and non-participants—still rely on outdoor wells for water, but participants report a larger increase in access to outdoor and indoor taps compared to non-participants. About 60% of non-participants rely on outdoor wells for water compared to roughly 54% of participants. The proportion of participants with access to outdoor taps increased from 14.6% to 18% while the proportion of non-participants increased marginally from 4.2% to 5.1%. The percentage of participants with access to indoor taps also increased from 10.7% to 11.1% while the percentage of non-participants with access to indoor taps declined from 4.2% to 3.8%. Non-participants are also more reliant on the use of drilling machines and pumps for water relative to participants. Comparisons of the main sources of water across the three locations indicate that

households in Kolda are strongly reliant on wells, both outdoor and domestic, while those in Tambacounda obtain their water from a broader range of sources, including taps and drilling machines. In Koussanar, participant households have increased their access to outdoor and indoor taps while non-participants are more reliant on wells and pumps. Specifically, participant households are transitioning from the use of outdoor wells to outdoor taps, as the percentage of participant households with access to taps has increased steadily from 35% in 2013 to 50.8% in 2015 and 53.4% in 2016 while their usage of outdoor wells has declined from 54.1% in 2013 to 35.1% in 2015 and 35.4% in 2016.

Figure 55: Households' source of drinking water

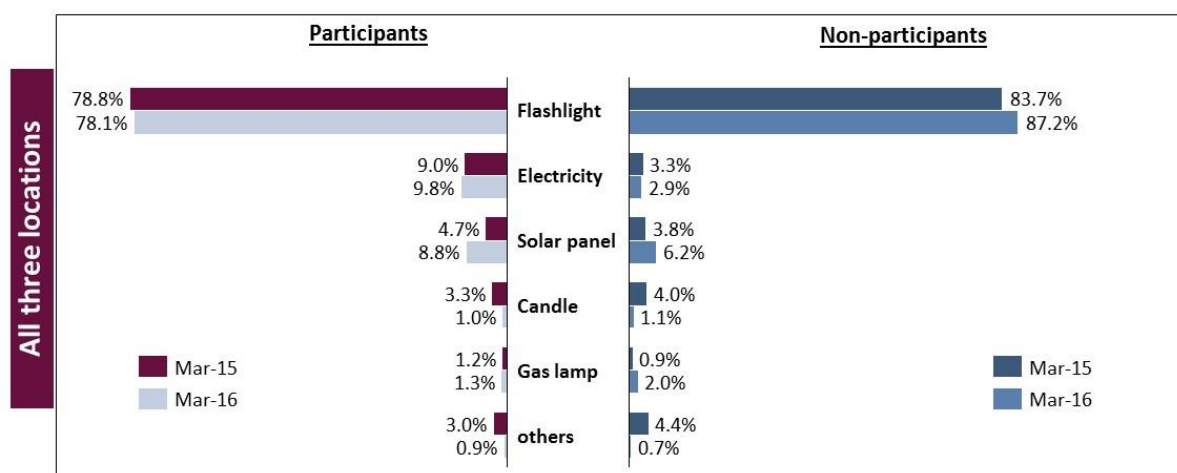


The majority of households rely on flashlights for lighting, but participants report a larger increase in access to electricity and solar panels between 2015 and 2016 than do non-participants. Participants with access to electricity increased from 9% to 9.8% while non-participants with access to electricity reduced from 3.3% to 2.9%. While both groups reported an increase in the use of solar panels, the rate of increase was greater for participants. A comparison across the three locations indicates that participants in Tambacounda report a reduction in use of flashlights and increased access to electricity while non-participants report an increase in the usage of flashlights and a

reduction in access to electricity. In Kolda, both participants and non-participants increased their reliance on flashlights and witnessed a corresponding decline in access to electricity. While flashlights are the most dominant form of electricity in Koussanar, participants report a larger increase in the use of solar panels, from 0% in 2013 to 9.9% in 2016 compared to 0% in 2013 to 2.4% in 2016 for non-participants.

Participants and non-participants across all three locations increased the use of firewood and reduced the use of charcoal for cooking. In Kolda, participants who use firewood for cooking increased from 91.3% in 2015 to 99.4% in 2016; in Tambacounda, the percentage increased from 88.5% in 2015 to 91% in 2016; in Koussanar, this percentage increased from 78.6% in 2015 to 86.2% in 2016. Among all non-participants, there was a similar increase from 88% in 2015 to 94.9% in 2016. Recent policy measures taken by the government to control logging may explain households' substitution of charcoal with firewood.²⁷ While charcoal is usually produced from freshly felled logs, dried and aged pieces of wood can be used as firewood, making firewood supplies less likely to be affected by increased efforts to monitor and prevent the cutting of trees.

Figure 56: Households' source of light



²⁷ Ministère de l'Environnement et du Développement Durable, "Lutte contre la coupe abusive de bois dans les régions de Kolda et Sédhiou", June 29, 2015. Accessed at: <http://www.environnement.gouv.sn/actualites/lutte-contre-la-coupe-abusive-de-bois-dans-les-r%C3%A9gions-de-kolda-et-s%C3%A9dhiou>