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QUANTITATIVE FINDINGS FROM THE SECOND PHASE OF A MIXED METHODS STUDY ON THE SUSTAINABILITY OF THE VIM PROGRAM IN KAYA, BURKINA FASO

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ViMPlus is part of USAID's Resilience in the Sahel Enhanced II (RISE) program, which supports vulnerable communities in Burkina Faso and Niger to effectively prepare for and manage recurrent crises and pursue sustainable pathways out of poverty.

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LIST OF ACRONYMS

ANC	Antenatal Care
BL	Baseline
CBW	Community-Based Worker
CHA	Community Health Agent
CDDS	Child Dietary Diversity
EL	Endline
FU	Follow-up
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
HDDS	Household Dietary Diversity
IDP	Internally Displaced Persons
IQR	Interquartile Range
IYCF	Infant and Young Child Feeding Practices
LIP	ViM Program Local Implementing Partners
MAD	Minimum Acceptable Diet
MLA	Mother Leader Animator
NGO	Non-Government Organization
NRM	Natural Resources Management
PL	Producer Leader
PO	Producer Organization
PPS	Probability Proportional to Size
SILC	Savings and Internal Lending Committee
TBA	Traditional Birth Attendant
USAID	United States Agency for International Development
VVV	Volunteer Village Vaccinator
ViM	Victory Against Malnutrition
WASH	Water, Sanitation, and Hygiene
WDDS	Women's Dietary Diversity

EXECUTIVE SUMMARY

Background: Victoire sur la Malnutrition (ViM) was a Multi-Year Assistance Program (MYAP) implemented by ACDI/VOCA with funding from Food for Peace from 2011 through 2018 in Sanmatenga Province of Burkina Faso. In 2018, the ViM program ended, and a follow-on Activity, ViMPlus, was launched in much of Sanmatenga Province. The commune of Kaya was not included in ViMPlus, so for Kaya, support ended in 2018. The withdrawal of resources from Kaya commune created an opportunity to assess the degree to which the activities, outcomes, and impacts achieved by ViM had been sustained (or improved or declined) in the years after program closure, and how plans for sustainability incorporated into program design contributed to these results.

In 2020, Tufts University in collaboration with ACDI/VOCA initiated a study to assess program sustainability. This assessment consists of three phases: a qualitative investigation of beneficiaries, service providers, and other stakeholders conducted in the summer and fall of 2020 (reported [here](#)), a quantitative population-based survey of households in beneficiary communities conducted in June 2021, and a quantitative survey of service providers, completed in March 2022. The present report describes the results of the quantitative household survey.

Between the time of ViM's closure and the time of the follow up survey, conditions in Burkina Faso have worsened, with climate-related weather shocks affecting agricultural production and productivity, an increase in insecurity and armed group violence which is spurring a large-scale population displacement, and the onset of the Covid-19 pandemic.

Program Activities: ViM intended to increase food security and improve livelihoods in the province through three strategic objectives: SO1: increase productivity and food availability through improved agricultural practices and technologies and enhancing value chains of key agricultural products; SO2: increase household income by improving value chains, stimulating links between producers and buyers, exploring alternative income opportunities, and facilitating access to credit; and SO3: reduce chronic malnutrition among children under five years of age and pregnant and lactating women. In addition, the program sought to achieve three cross-cutting objectives: gender equity, women's empowerment, and environmental improvements.

Under SO1, ViM sought to increase agricultural production through adoption of good agricultural practices (GAPs) and use of improved inputs. ViM also sought to diversify production into cash crops, including sesame and cowpea, tomatoes, onions, and other vegetables, and irrigated lowland rice. ViM trained farmer leaders who trained farmers using farmer field schools (FFS) and demonstration plots. ViM identified producer organizations (POs) linked to specific crops and strengthened them with training on marketing, business skills, and/or good agricultural production practices. They also organized input fairs to establish linkages with input suppliers, expecting these relationships to continue once the Program ended with no need for further input fairs. Sustainability was to be achieved through continued participation in POs, continued provision of training on the part of lead farmers even after contact with ViM ended, and continued and expanded marketing of crops, motivated by increased income. ViM trained community-level providers of livestock value chain services including veterinary services and vaccines. These 'volunteer village vaccinators' (VVs) were to continue providing livestock services after Program exit by charging livestock owners for their services and essentially becoming entrepreneurs.

Under SO2, ViM sought to improve household income through participation in savings and internal lending committees (SILCs) whose benefits were intended to continue after the end of the program through sustained membership motivated by financial benefits. Other strategies included promotion of increased marketing of agricultural products and increasing access to business development services for micro and small business owners.

Under SO3, ViM trained mother leader animators (MLAs) and community-based health agents (CBHAs) to provide training, growth monitoring, and some health services to women of child-bearing age in the community. ViM organized care groups to promote appropriate child feeding and care practices and water, sanitation, and hygiene (WASH) behaviors. Sustainability was to be achieved through sustained behavior change on the part of beneficiary mothers and by continued provision of services by MLAs after the end of ViM due to their commitment to continue providing services. CBHAs were supposed to be linked to the government's health system as paid employees after the end of the program, although this transfer did not occur as intended for many CBHAs. Rations were provided to pregnant and lactating women (PLW) and to children 6 – 23 months of age, for which there was no sustainability strategy, but the provision of rations was intended to incentivize mothers to attend clinics for antenatal and postnatal care including growth monitoring, nutrient supplements, and immunizations. Rations themselves are not sustainable, given that they constitute provision of free food. However, the behavior change was intended to be sustained.

Women's empowerment was promoted through the organization of community groups and the provision of training on agriculture, economic activity, and gender roles, with training delivered by both health service providers and producer leaders.

Results: The picture that emerges is mixed. A key sustainability strategy of ViM was to form groups and train community-based workers (CBWs) as leaders with the intention that these groups would become self-sustaining and that trained CBWs would continue to provide services after the program ended. The expected motivation for this dynamic differed by type of group and by CBW type under each strategic objective (SO). ViM also supported education of beneficiaries on economic activity, agricultural production, and health-related behavior, expecting the promoted practices would continue to be applied after exit based on the benefit experienced.

SO1: Between endline and follow up, membership in all the POs fell substantially, and joint purchases of inputs or sales of produce did not exceed 10% of the producers of each crop even at endline, with no significant change at follow up. Given that the endogenous trainer model was introduced fairly late, during year 5 of ViM Program implementation, one should not necessarily conclude that the PO model itself is ineffective, but rather that the implementation may have been too rushed to be effective, with no real possibility for gradual handover of responsibility in the context of ViM Program close-out. There was some concern that the worsening security situation between endline and follow up as well as the Covid-19 pandemic and associated restrictions on movement and public gatherings might have inhibited meetings of POs and thus decreased participation.

There have been some sustained successes. Crop diversification increased during the Program and continued to increase by the time of follow up, with significant increases in the percent of farmers producing both subsistence and cash crops. In addition, farmers report increased use of many of the inputs promoted by ViM, including a wide range of agricultural equipment and inputs. This suggests that irrespective of PO membership, the benefit derived from these inputs was incentive enough to continue use when they were no longer provided or subsidized.

The percent of farmers selling crops decreased significantly from endline to follow up, likely due to many smaller farmers not being able to produce enough to generate a marketable surplus. PO members, those with larger cultivated area, and those producing cash crops were more likely to engage in sales. Average numbers of poultry and goats/sheep increased, but sales of cattle and poultry also increased. Although these are mixed results, the sale of livestock is consistent with reduced livestock ownership at follow up and with the fact that farmers reported selling livestock as a coping strategy for dealing with agricultural and climate shocks. Selling livestock may also be a means of coping with the worsening security situation, as livestock are often targeted by terrorists and other armed groups.

Although the expectation was that producer leaders would continue to provide services without the remuneration previously received out of commitment to the Program and a desire to share the knowledge gained from their own training, at follow up, only about 25% of farmers reported knowing a producer leader and 28% knew a VVV. However, of those who reported knowing these service providers, 78% said they received training or services from producer leaders and 75% reported receiving services from a VVV. The percent of farmers who obtained their vaccinations from the VVV fell from endline to follow up; the fact that a quarter of farmers at follow up reported getting vaccines from a VVV suggests that, for at least some, the model of sustainability worked.

SO2: The picture is mixed regarding longer-term impacts under SO2. Domestic asset ownership increased from endline to follow up except for livestock; with livestock included, value of assets fell. Similarly, household dietary diversity fell both during and after the end of the Program, while the experience of household hunger was greatly reduced from its level at baseline (not measured at endline).

ViM formed Savings and Internal Loan Committees (SILCs) as a mechanism for funding small businesses to improve income sustainably. But membership in SILCs declined substantially after the program ended, and the number of households reporting small business as a primary revenue source fell over the same period. SILC membership may have dropped due to SILCs falling into inactivity in some communities. Reported receipt of training related to SILC also declined to negligible levels. As is the case with POs, formation or strengthening of SILCs did not appear to result in their sustainability.

SO3: Prevalence of stunting in children, which was reduced over the life of the Program (attributed in part to distribution of supplementary food rations), rose at follow up but was still below baseline rates. The percent of children achieving minimum acceptable diet was quite low at the end of the program and remained low; this indicator did not appear to be affected by ViM. The percent of children who were put to the breast during the first hour after birth increased from 54% at baseline to 84% at endline, and this number further increased to 88% at follow-up. This was a significant positive result of ViM's social and behavior change communication (SBCC) strategy that was sustained after the program.

There was a decline in the use of many health care services compared to endline (antenatal care, growth monitoring, receipt of dietary supplements), though rates at follow up were still above those at baseline. During the life of the program, services were provided in the community by the health workers (MLA, CBHA) trained by the program. For antenatal care, growth monitoring, and supplements, mothers and caregivers now obtain these services from their local health centers, not all of which are within the community. Other possible explanations for the decline in use of health care services could be a regression in ideas about gender roles (which was observed by this study),

the cost of accessing these services after ViM program closure, and restrictions on mobility due to insecurity and Covid-19. Provision of rations is inherently unsustainable, but the availability of rations might have incentivized caregivers to make use of health services, and the withdrawal of rations may have contributed to the decline their use. There was successful adoption of some health practices, but sanitation practices (other than improved latrine) declined.

Evidence for the sustainability of the CBW model is mixed. At follow up, few people reported receiving the kind of training (health, nutrition, sanitation) that had been provided by MLAs, and reported membership in care groups was negligible. Almost 60% of mothers knew of an MLA in their community, but of these, only 18% reported receiving services (with the caveat that mothers may not have defined training as a service in the same way as growth monitoring or provision of supplements).

Cross-cutting Gender: Women's reported participation in decision-making rose during ViM but fell to below baseline rates at follow up, but on the question of gender-based violence, there was substantial improvement over the life of the Program; acceptance of such violence increased somewhat at follow up but remained well below baseline levels, showing a positive long-term effect. Participation in women's groups, though, declined substantially, including women's economic groups, women's empowerment groups, and women's literacy groups, all of which had participation rates below three percent at follow up. Care group participation was around six percent. Women's participation in agricultural groups fell from over half to 14% over that time. Women's receipt of training on childcare, WASH, and nutrition was below 10% at follow up. As with POs and SILCs, these groups did not persist once support of the Program was withdrawn. The ongoing security situation and resulting internally displaced persons (IDP) crisis in Kaya may be partly to blame for the observed decrease in activity of women's groups between endline and follow-up. Group meetings have recently become risky in many communities, and many households are hosting IDPs from further north, putting strain on land, food, and other resources.

Shocks and resilience: Between endline and follow up, Burkina Faso experienced a range of shocks and stresses that could have a substantial impact on the sustainability of program activities and benefits. In qualitative investigation, shocks related to the current security situation were widely cited, but in the follow up survey, the most frequently reported shocks – cited by almost 80% - related to climate and to agricultural production. Experience of terrorism was far less common, as was the experience of challenges due to an influx of displaced persons, both at about 20%, although fear and anxiety related to security were common concerns. As a result, the coping strategies reported by households largely had to do with managing reduced income by economizing and reducing purchases and consumption. Selling livestock was another common coping strategy, but the most extreme coping strategies – selling off agricultural equipment, sending family members away, or migrating – were uncommon. The majority of household respondents said they were able to recover from the shocks they had experienced – defined as being able to meet their food needs – or even improve their situation compared to what it had been, suggesting a promising level of resilience.

Effectiveness of ViM Sustainability Strategies: The mixed picture of sustained activities and impacts raises questions about the sustainability strategies implemented under ViM. There were several well-sustained behaviors. In the agricultural sector, these included a high rate of crop diversification and many cases of increased use of agricultural equipment and improved inputs; in the health sector, breastfeeding within the first hour and obtaining complete vaccination for

children were sustained. Many indicators that declined from endline still remained above baseline levels. But many other indicators showed a decline, including agricultural sales, household diet diversity, women's diet diversity, child stunting (an increase, that is, a negative change) and diet quality, and use of health services.

The strategy of using existing groups such as producer organizations and care groups or forming new groups such as savings and internal lending committees showed disappointing results. Motivation was apparently lacking to remain in such groups once the organizing force of ViM was absent and there could be no expectation of benefits from the Program. Participation in all such groups fell to low levels. The sustainability model of establishing or strengthening producer or savings and loan organizations has had success in other settings, where profit provided the motivation and resources to continue applying skills and management expertise learned during a development program. Whether the barriers to sustainability in the context of Burkina Faso lie in the deteriorating climate and security situation, insufficient benefit due to market conditions, or socio-cultural factors, this model needs to be re-assessed for its applicability in the current context of Burkina Faso, and motivations strengthened, or alternative approaches possibly identified.

The strategy of training community service providers who were then expected to continue their work after ViM's exit had mixed results. In the agricultural sector, village vaccinators were trained to provide services on a small business model. Though fewer farmers obtained vaccines from the VVV at follow up than at endline, these service providers were still a source for about a quarter of farmers. Some specific challenges – the quantity of vaccine in a single vial, the lack of refrigeration – might be remediable and increase the number of working VVVs. The evidence suggests that producer leaders reduced their provision of services after exit, possibly related to the fact that they were no longer receiving incentives such as free or subsidized agricultural inputs, reducing their motivation. MLAs also received benefits during ViM that were no longer given after exit, and the reduction of MLA activity is reflected in the steep decline in reports of health and nutrition training and care group meetings. This decline in trainings and care group meetings could also be due in part to imperfect integration of these groups into the community health system by the Burkinabè government. Integration of CBHAs into the health system was a major assumption based upon which the CBW model was designed. The decline in service provider activity when incentives and remuneration are withdrawn has been documented in a wide range of settings. Alternative models that have the potential for continuing motivation of service providers need to be developed, possibly related to local, community-based organizations able to provide incentives and to promote demand for these services on the part of beneficiaries. Anecdotal evidence suggests that the local implementing partners (LIPs) did not continue their support once ViM ended its support – both financial and administrative. Given this context, community-based organizations might provide another approach. Further information on service providers will be forthcoming in a report of the service providers survey.

Persistence of behavior change resulting from beneficiary training was also mixed. Adoption of some good agricultural practices and improved inputs remained high at follow up; use of others declined. Qualitative investigation suggested practices that did not require expenditure or group labor were more likely to be sustained, but most farmers who used improved inputs cited increased production. The consistent decline in indicators of diet quality is as likely due to constrained income and decreased production as to lack of knowledge, but this is not the case with knowledge of sanitation practices. The lesson here is that behavior change needs reinforcement; education is

valuable, and skills and knowledge can be maintained if they are continuously applied, but mechanisms for continuation of behavior change communication are likely needed for the behavior change to persist. This could possibly be addressed through moving beyond social behavior change communication and instead focusing on social behavior change. This could be accomplished using more robust formative research including human-centered design to find locally appropriate solutions to promote increased sustainability.

The path forward: Sustainable change is not easy. Activities initiated under ViM may have been affected by external conditions including climate shocks, insecurity due to terrorism, and the pandemic. The timeline for achieving change may be unrealistically constrained. Sustainability strategies that depend on establishing linkages with local partners need to be based on a realistic assessment of those partners' motivation, capacity, and resources to facilitate continuation of the services they are intended to support. Giving free resources is inherently unsustainable, but temporary provision of subsidized inputs may give beneficiaries the opportunity to experience benefits that will motivate them to obtain these inputs on their own at market price, if in fact those benefits are realized. The experience of ViM demonstrates that models that have been successful in one social, environmental, and economic context may need adaptation or simply not be applicable in a very different setting. The assumptions underlying these models need to be assessed critically based on local conditions during the design and modification phases of interventions and on an ongoing basis throughout the life of the activity. Additionally, implementation of a robust collaborating, learning, and adapting (CLA) process may be of importance in contributing to meeting sustainability objectives in the long term.

One lesson from the ViM experience is that practices and behaviors that are feasible and valued can indeed be sustained and expanded. Practices whose benefit is not recognized or whose promise of profitability is not realized, however, are unlikely to persist, though they may be adopted while external actors from the development program are organizing and incentivizing them. Ultimately, the long-term sustainability of behaviors and activities that result in sustained impact depend on the experience of the communities themselves and on the community's own perception of their value and benefit.

I BACKGROUND

1.1 Development Programs and Sustainability

Historically, development programs have not been assessed for sustainability, or sustainability assessment has not been an overarching priority. Conceptualizations of sustainability vary, but a predominant perspective in international development defines sustainability as sustained delivery of services and outcomes past the end of a program's lifetime[1-5]. From this perspective, the flow of benefits to beneficiaries continues "with or without the programs or organizations that stimulated those benefits in the first place"[6]. Other scholars further underscore that the flow of benefits should continue beyond the investment of program funds[2].

Although most development programs are assessed for impacts at the end of program implementation, assessing sustainability requires conducting further analyses after program closure to determine whether or not these impacts and benefits have persisted after external program investments end. A recent study of development food security activities (DFSAs) has shown that impact at the time of program exit does not necessarily predict longer term benefit, implying that impact evaluations do not always provide a complete picture of long-range program

effects [7]. What remains after donor resources are no longer provided is critical to ensuring durable, resilient, effective development. In addition, climatic and human-generated shocks and stresses are increasingly affecting global food security[8]. For sustained impacts, development initiatives must take into account how results and expected sustained activities, service delivery, service participation, and behavior changes will respond to and overcome emergent risks.

Another important factor development program implementers should take into consideration is the amount of time required for a change to take place and become institutionalized within a population group or community. There is a dearth of information in the literature to show whether the standard five-year development program is sufficiently long to produce long-term sustainable changes in diet, hygiene, and livelihood behaviors, and this is further compounded by the need to conduct an endline survey before the completion of the five-year period. This reality highlights the need for sustained provision of behavior change communication after the conclusion of a development program to promote long-term concretization of targeted behavior changes.

Resilience in the face of changes in shocks and stresses, whether social, economic, political, or climatological, is also key to achieving development outcomes and sustaining them post-program [9, 10]. Strengthening resilience capacities is essential to enabling households to absorb, mitigate, and adapt to changes. Escalations of conflict, climate shocks, and internally displaced persons (IDPs) increasingly challenge global food security, and the Centre-Nord region of Burkina Faso is currently confronted with all of these shocks and stresses [8]. Development initiatives must therefore contend with the presence or anticipation of such shocks and stresses in program design, implementation, and adaptation. Understanding how to bolster resilience capacities among individuals, communities, and institutions has therefore become critical to successful development programs [11, 12]. Further, guidance on designing food security interventions whose effects can persist in the presence of such shocks is also critical, especially in contexts where the potential for periodic shocks is high. There may be specific components of an intervention that can be designed and implemented in anticipation of presumptive shocks and stresses to increase the likelihood of resilience to changing circumstances. The duration of a program is another consideration. Food assisted development programs such as ViM are typically funded in five year cycles, with the first year devoted to “refining and implementing” proposed activities and modifying plans in response to this field testing. Impact evaluations typically occur early in the fifth year of the program. Thus approaches to achieving sustainable change in behaviors and local structures (organizations, service providers) must be designed to accommodate this time frame.

1.2 Summary of the ViM Sustainability Study

The current study assesses the sustained impact and activities of ViM in Kaya, including use of practices and behaviors as well as participation in organizations and trainings. ViM ended in 2018 after receiving a 2-year extension, so the program was in effect for seven years, from 2011 to 2018. The conclusion of ViM was followed by the launch of ViMPlus in 2018, which is currently underway in the Centre-Nord Region of Burkina Faso. Of the four communes (administrative divisions) covered by ViM, three – Barsalogho, Namissiguima, and Pissila – are also part of the ViMPlus implementation zone. Conversely, the fourth ViM commune, Kaya, is not part of the ViMPlus zone of intervention. The commune of Kaya therefore presents an opportunity to evaluate the sustainability of ViM outcomes and impacts more than three years after its closure. There has not been a USAID-funded Resilience Food Security Activity (RFSA) in implementation in Kaya since ViM’s exit in 2018, though other programs whose objectives overlap to varying degrees with

those of ViM are currently being implemented in Kaya or have been implemented in the past. These include USAID-funded Resilience in the Sahel Enhanced (RISE) II programs such as TerresEauVie. The number of NGO and development programs being implemented in Kaya has been sustained especially by the influx of internally displaced persons (IDPs) into the municipality in recent years.

The sustainability assessment was conducted in three phases – a qualitative investigation of beneficiaries and program implementers (ACDI/VOCA, Save the Children, and three local implementing partners or LIPs) and service providers conducted in the summer and fall of 2020[13], a quantitative, population-based household survey conducted in June 2021, and a quantitative survey of service providers trained by ViM that was completed in March 2022. The quantitative household survey was designed to replicate the ViM Final Evaluation (endline survey or EL)[14], to assess the degree to which impacts and activities documented at the end of the Program have been sustained, improved, or worsened in the three years since program exit from the commune. This report presents results of the quantitative follow-up (FU) survey, compared with the results at endline and with data from the ViM baseline survey (BL) shown to see the trajectory of change both during and after the Program.

1.3 Seasonality and Beneficiary Status

The BL survey was conducted at the height of the lean season, in July of 2011, while the EL evaluation data were collected from late November to mid-December 2017, during the harvest period, when food was more plentiful. The FU survey was conducted in June of 2021, once again in a pre-harvest period of scarcity. Changes in outcome indicators from BL to EL and from EL to FU, particularly those related to diet quality and food security, need to be interpreted with this difference in mind. Dietary diversity, prevalence of household hunger, and prevalence of minimum acceptable diet among children may be affected by these seasonal differences. Specifically, since endline data were collected in the month of December, in the middle of harvest activities for most households in the zone of implementation, these food security indicators may be more positive relative to data collected for the baseline and follow-up surveys, when food insecurity is expected to be more pronounced, creating the possibility of observing misleadingly positive impacts measured between BL and EL. Figure 1 shows in schematic form the seasonal calendar for Burkina Faso.

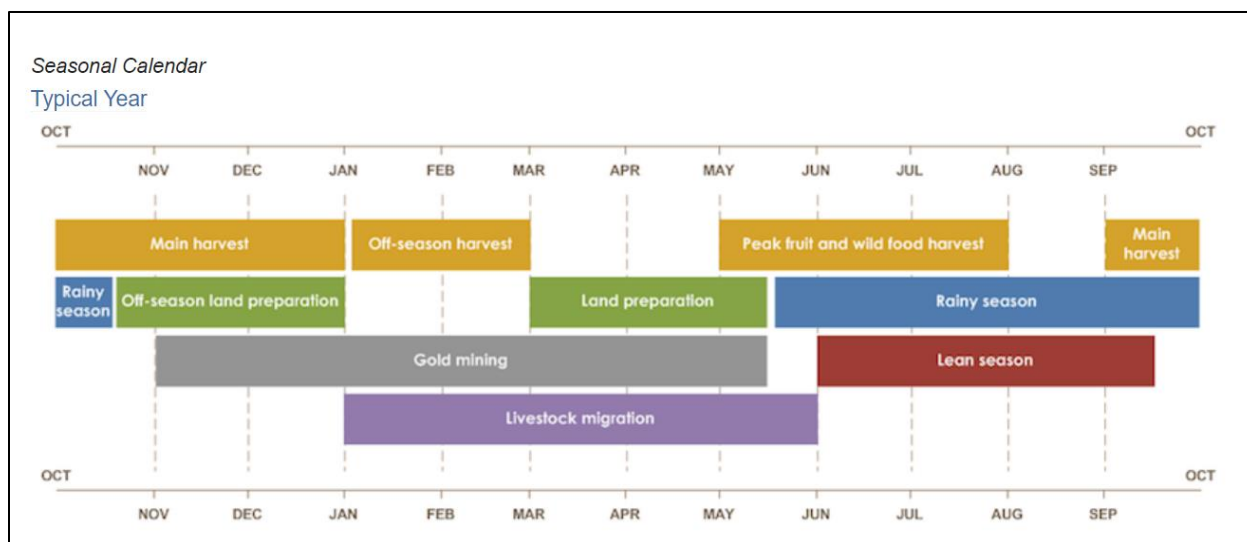


Figure 1. Seasonal calendar for a typical year in Burkina Faso. Source: Famine Early Warning Systems Network[15]

When discussing sustainability of a development program initiative such as the ViM Program, a key challenge involves identification of former beneficiaries, especially several years after closure. Results from the quantitative follow-up population-based household survey conducted in June 2021 show that rates of reported beneficiary status are significantly lower among respondents than during the ViM endline survey in 2018, possibly because respondents were simply unable to recall whether they were beneficiaries. This could have occurred due to the amount of time that has passed since respondents participated in ViM trainings and activities. Additionally, respondents could have been confused about how to respond to the question, perhaps thinking that simply attending ViM trainings does not qualify one as a beneficiary. A specific case is the agricultural and livelihood training program, which was dispensed at the producer organization (PO) level, while the present survey data were conducted at the household or individual level. Perhaps some respondents did not consider themselves to be individual beneficiaries although they were members of a PO that received trainings from ViM. Another possibility is that with the number of non-government organization (NGO) and international institutions implementing programs in Sanmatenga Province and the Centre-Nord Region, survey respondents' recollection of the specific programs in which they have participated as training attendees is clouded. In any case, the Program was intended to have an impact on the wider community beyond the specific pool of direct program beneficiaries; it is appropriate to evaluate these indicators at a community or population level rather than restricting the analytical pool to those who interacted directly with ViM.

2 THE ViM PROGRAM

2.1 Economic, Political, and Environmental Context

ViM was implemented in rural Sanmatenga Province of Centre-Nord Region in Burkina Faso from 2011 to 2018. The implementation zone is characterized by rural communities where crop cultivation and animal husbandry are the principal means of livelihood. To understand ViM, it is important to understand the economic, social, environmental, and political context of the program implementation zone and in the country. In Burkina Faso, agriculture contributes 25% of the

country's GDP and employs 80% of the country's working population [16]. Agricultural systems are centered on small-scale livestock raising and smallholder rainfed cultivation of several staple crops, including two cash crops (rice and cotton), several cereal crops (maize, millet, and sorghum), and leguminous crops (cowpea and groundnuts) destined for both home consumption and income generation. Average plot sizes are less than 5 hectares; there are low levels of mechanization and improved input use[17]; and average fertilizer application rates are below the average for Sub-Saharan Africa and well below the world average[18].

Burkina Faso is currently facing challenges with food insecurity that are being compounded by several factors, including climate-related weather shocks, diseases affecting agricultural production and productivity, insecurity and armed group violence which is spurring a large-scale internally displaced persons crisis, and the Covid-19 pandemic[19, 20], with 4.8 to 11.7 percent of the population experiencing global acute malnutrition in December 2019[19]. Acute food insecurity is more severe during the lean season and in the Sahelian northern region of Burkina Faso[21]. Many of the communities in the ViM implementation zone are located at the southern edge of the Sahel ecological region, although they are located in the Centre-Nord political region. In order to meet food security needs for rural populations in the region, researchers recommend a mixture of subsistence and market-based production[21] as well as increasing production diversity and improving on-farm environmental quality through activities such as tree-planting [22].

Addressing the evolving security crisis is more complex. Terrorist attacks have proliferated since 2015, leading to the internal displacement of hundreds of thousands of Burkinabè civilians. Many of these displaced people faced conditions of food insecurity in “normal conditions” before being forced to leave their homes, and their economic and food security situation has worsened since taking up residence in IDP camps or host communities. These economic impacts are further compounded by the Covid-19 pandemic and its repercussions on global and regional economies [23]. Kaya commune is a major destination for internally displaced persons coming from communities further north where the security situation has deteriorated significantly. Many rural villages throughout Kaya as well as the wider ViM implementation zone are currently hosting internally displaced persons, putting additional strains on communities already facing climatic shocks, environmental problems, agricultural production constraints, and food insecurity[13, 14].

Climate change, land degradation, and pressure on available land and water resources are also causing difficulties in Burkina Faso[24]. Climatic data show that temperatures have already risen between 0.2 and 2 degrees C over the last three decades in the Sahel, with a decrease of 250-300 mm in average yearly rainfall at the regional level[25]. Predicted future impacts include delayed onset and early conclusion of the rainy season and increased frequency of high-intensity rainfall events during the rainy season[24, 26]. Cultivation of marginal lands, lack of access to inputs and capital, and reliance on rainfed agriculture have resulted in low adaptive capacity of farm households to weather-related shocks and greater vulnerability to food insecurity.

2.2 ViM Program Summary

ViM was intended to increase food security and improve livelihoods in Sanmatenga Province through the achievement of three Strategic Objectives:

SO1: increase productivity and food availability through improved agricultural practices and technologies and enhancing value chains of key agricultural production;

SO2: increase household income by improving value chains, stimulating links between producers and buyers, exploring alternative income opportunities, and facilitating access to credit; and

SO3: reduce chronic malnutrition among children under five years of age and pregnant and lactating women.

In addition, the program sought to achieve three cross-cutting objectives: gender equity, women's empowerment, and environmental improvements.

Under SO1, ViM sought to increase agricultural production through adoption of good agricultural practices (GAPs) and use of improved inputs. The program also sought to diversify production into cash crops, including traditional cash crops of sesame and cowpea, market gardening of tomatoes, onions, and other vegetables, and irrigated lowland rice production. ViM trained farmer leaders who trained farmers using farmer field schools (FFS) and demonstration plots. ViM identified producer organizations (POs) linked to specific crops and strengthened them with training in both production techniques and management/marketing. They also organized input fairs to establish linkages with input suppliers, expecting these relationships to continue once the program ended with no need for further input fairs. Sustainability was to be achieved through continued participation in producer organizations, continued provision of training on the part of lead farmers even after contact with the program ended, and continued and expanded marketing of crops, motivated by increased income. Another objective of ViM that falls under SO1 involved training and facilitating community-level providers of livestock value chain services, especially but not limited to provisioning of livestock vaccines and associated veterinary services. These providers were called *vaccinateurs volontaires villageois* (volunteer village vaccinators, or VVVs) by ViM. Following the conclusion of ViM, the VVVs were to continue providing livestock services in their communities, transitioning to a fully entrepreneurial model by charging livestock owners the full market value for the services they provide. (These services were partially subsidized by ViM during program implementation.)

Under SO2, ViM sought to improve household income through various interventions, including participation in savings and internal lending committees (SILCs) whose benefits were intended to continue after the end of the program through sustained membership motivated by the financial returns. Other strategies for improving household income involved leveraging partnerships to promote increased marketing of agricultural products and increasing access to business development services for micro and small business owners.

Under SO3, ViM trained mother leader animators (MLAs) and community-based health agents (CBHAs) to provide training, growth monitoring, and some health services. ViM organized care groups to promote appropriate child feeding (exclusive breastfeeding to six months, appropriate complementary feeding, infant and young child feeding and care practices [IYCF]). The community-based MLAs and CBHAs promoted appropriate WASH behaviors. Sustainability was to be achieved through sustained behavior change and continued participation by MLAs after the end of the program due to their commitment to continue providing services. CBHAs were to be linked to the government's health system as paid employees to be based in local communities through the *Centres de Santé et de Promotion Sociale* (Health and Social Promotion Centers, CSPS). Rations of supplementary food were provided to pregnant and lactating women (PLW) and to children 6 – 23 months of age, for which there was no sustainability strategy, but the provision of rations incentivized mothers to attend clinics for antenatal and postnatal care including growth monitoring, nutrient supplements, and immunizations. Rations themselves are not

QUANTITATIVE FINDINGS FROM THE SECOND PHASE OF A MIXED METHODS STUDY ON THE SUSTAINABILITY OF THE ViM PROGRAM IN KAYA, BURKINA FASO

sustainable, given that they constitute provision of free food. However, the behavior change was intended to be sustained.

The present quantitative report builds on the insights derived from the earlier [ViM Sustainability Qualitative Study](#), which contains an analysis of focus group and key informant interview data collected from ViM local implementing partners, former beneficiaries, and external stakeholders in 2020 [13]. The results of the population-based household survey presented in this report will be complemented by a parallel survey of service providers trained by the ViM program, for which data collection has been completed, and whose report is currently forthcoming.

3 METHODS

The goal of the present study was to assess the degree to which activities, outcomes, and impacts of ViM reported at endline have been sustained, improved, or declined in the three years since the program ended, and to determine why this was the case. The activities undertaken in the program incorporated specific strategies designed to promote sustainability; this report assessed, to the extent possible, whether these sustainability strategies were effective. To achieve this, we largely replicated the endline survey in order to produce results that would be comparable. In the years since ViM ended (in 2018), there has been an onset of terrorist activity and security threats that altered the social and economic context from what it had been during ViM. Other factors included the Covid pandemic with its attendant constraints on mobility and group activities, and climate shocks including excessive rainfall and flooding as well as drought. To determine the effect of these changes on program outcomes, a set of questions on respondents' experience of shocks and stresses was added to the data collection instruments, along with information on households' coping strategies and their own assessment of how well they were able to recover from each type of shock and provide sufficient food for the household.

The endline survey attempted to assess the effects of ViM on direct beneficiaries (those that had participated in program activities such as training and group membership) as distinct from community members who had not participated directly. As noted, in 2021 when the follow up survey was conducted, respondents largely did not recall their participation. The present (follow up) survey was population based, drawing a representative sample of households, women of reproductive age, children under five, and farmers, without attempting to determine beneficiary status.

Survey methods are described in the following sections.

3.1 Sampling

This component of the ViM post-program sustainability study consists of a representative population-based household survey conducted throughout Kaya commune in June 2021. Approximately 2,300 randomly selected households in 48 randomly selected villages were surveyed for this activity. The sample size was calculated using the calculations developed by Magnani and modified by Stukel for use in population-based surveys to evaluate USAID programs [27, 28]. The sample size was calculated based on the target number of children under five years of age needed to be able to detect a five-percentage point difference in key anthropometric outcomes (stunting and underweight) from the ViM endline survey with 80% statistical power and 95% as a one-tailed statistical significance threshold. Following the sampling protocol cited above,

the target number of children under five years of age is 1,843. To ensure that this target would be reached, it was necessary to reach 2,300 households and a total of 2,600 participants. Interviews were conducted with various respondents in the household depending on module (household head; women of reproductive age; farmers). Anthropometric measurements were taken on all children under the age of five.

The first stage of sampling consisted of randomly selecting 48 villages within the commune of Kaya using systematic probability proportional to size (PPS). After selecting the 48 villages, a team of 16 enumerators and three supervisors conducted a household listing of all households in each of the selected villages. The second stage of sampling involved segmenting villages that had over twice as many households as the average number of households across the 48 selected villages.

The third stage of sampling involved selecting 50 participant households in each of the 48 villages using the fractional interval systematic sampling method using the household lists obtained during the listing phase. The final stage of sampling involved selection of individual respondents within each household. The following respondents were interviewed in each household: the head of household (identified by household members), the woman responsible for preparing food for the household, all women between 14 and 49 years of age, all children under 5 years of age, and all farmers in the household, where farmers were defined as any member with control over a productive plot of land (whether field crop or kitchen garden).

3.2 Enumerator Training, Pre-Test, and Data Collection

Twenty-seven enumerators were hired and trained to collect the household survey data, of whom 16 had participated in the initial household listing. The survey modules were administered on tablets using the Open Data Kit (ODK) application. After completing the training, enumerators conducted a pretest and a pilot test of the survey instrument, with both ViMPlus staff and rural farmers in Kaya participating in these activities. Survey data were collected in June 2021. This corresponds seasonally with the ViM Baseline survey but not the ViM Endline survey (for which data were mostly collected in the month of December). Data were uploaded to the ONA server at the end of each day or when the tablets were in the city of Kaya with a sufficient internet connection. Data were spot-checked and verified by the enumerator supervisors and program consultants on the ground in Kaya.

3.3 Data Processing and Analysis

Once data collection was complete, the individual modules were downloaded and read into the Stata 17 software program, cleaned, and processed for analysis.

ViM outcome and impact indicators were calculated using the same process that was used during the ViM Endline study. To ensure a comparison, the ViM Baseline and Endline datasets were disaggregated by commune, and all indicators were re-calculated for Kaya only. All variables in West African CFA francs (XOF) were deflated to the 2017 value by first converting XOF values to USD using an average exchange rate over the data collection period, then deflating to December 2017 USD using the Consumer Price Index (CPI), then converting these values back into XOF using the appropriate exchange rate averaged over the ViM Endline survey data collection period. All anthropometric indices were calculated using the WHO Stata macro for survey analysis [29]. The formula for statistical comparison of means is the two-sided t-test, in which the test statistic

follows a Student's t-distribution. 1 Statistical significance was reported at $\alpha = 0.1, 0.05,$ and $0.01,$ respectively for a two-sided test.

Further econometric analyses were conducted to examine determinants of sustainability using the 2021 study data. Topics of these regressions include agricultural production and productivity, adoption of various good agricultural practices (GAPs) and sustainable natural resources management (NRM) practices, and marketing of agricultural products. Regression analysis was conducted using probit models, which are appropriate for regressions in which the dependent variable is binary. The independent variable coefficients describe the impact of a one-unit increase in the independent variable on the probability of the dependent variable being equal to one. However, since the distribution of the equation is non-linear in nature, these coefficients cannot be readily interpreted without a transformation. Therefore, we used the coefficients to compute the marginal effects of each variable on the outcome of interest. 22

3.4 Study Limitations and Strengths

There were several limitations associated with this study. There was a discrepancy between observed household composition and expected composition based on previous surveys in the same area. This was addressed by conducting a follow-up household roster survey on ten percent of the original respondents. Results of this follow-up study are presented in the first part of the results section below. The number of CBWs identified in the households was small, resulting in insufficient sample sizes to analyze service provider behavior. A separate survey of service providers was therefore undertaken; report of the results of this survey are forthcoming. Respondents were asked about their engagement with ViM activities during the 2012-2018 period, such as receipt of rations, participation in various trainings, or serving as different types of service providers (MLA, etc.). These reported rates of participation in ViM activities were markedly lower than rates reported during the endline survey (as noted above), likely due to failure of recall; data were not analyzed by beneficiary status. In calculation of total household assets, large variation was found in the reported resale value of household, productive, and transportation assets, which is consistent with the generally recognized position that reported value is an unreliable measure of household wealth. This was mitigated by removing outliers as well as by primarily using indices of ownership as a measure of wealth, rather than resale values of individual asset categories.

As noted above, in the interval between the EL and FU surveys, Burkina Faso faced a variety of developments and shocks, including the worsening of armed group violence against military and civilian targets, the COVID-19 pandemic, internal displacement, and increasing food insecurity due to climatic factors.

A strength of the survey is the large sample size. The survey sampling frame included all households living in Kaya commune at the time of the survey, and over 2000 households responded to the survey, almost four times as many households as surveyed in Kaya commune by the endline survey. We replicated the approach of the endline survey, which targeted multiple respondents from each household, using adapted questionnaires for all women of reproductive age, farmers, household heads, and caregivers of children under 5 years old. Anthropometric measurements were collected from all children under 5 years of age. The findings of this quantitative survey will be complemented by the qualitative survey which was completed in 2020 as well as the service-provider survey conducted in early 2022.

4 RESULTS

4.1 Household Roster Composition and Verification of June 2021 Data

The results of the follow-up survey conducted in June 2021 revealed that the average household size was 6.63 members per household, significantly lower than the average household size of 7.67 members reported by the ViM endline study for which data were collected in December 2017. Average number of members in different categories (children, women of reproductive age, farmers) were also systematically lower.

In order to verify the June 2021 data on household composition, a verification was conducted in December 2021 in which we randomly selected a subsample of 240 households that had been included in the follow up survey and administered a full household roster to the selected households. A comparison of household composition data between ViM baseline, endline, the follow-up study, and the household roster verification is presented in Figure 2 below.

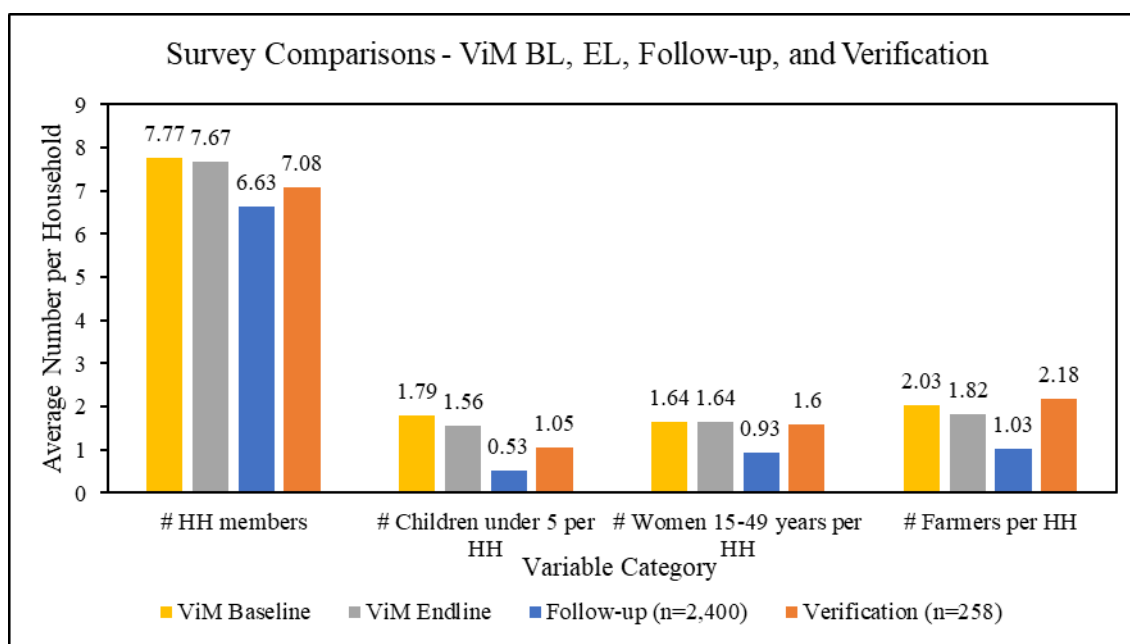


Figure 2: Household composition at ViM Baseline (2011), Endline (2018), and Follow-up (2021).

Household composition variables had lower values for the follow-up survey in June 2021 than at the time of the ViM baseline or endline surveys. The verification produced household composition data that are essentially similar to data collected during the ViM baseline and endline studies.

Results of the household verification showed a higher number of members per household (7.08 members) overall as well as higher numbers of children under 5 years of age (1.05 children under five), women of reproductive age (1.6 women), and farmers per household (2.18 farmers) than reported by the June 2021 survey. This suggests that the difference between 2018 and 2021 was likely due to differences in the way enumerators applied the definition of the household in the 2021 survey. Despite this difference, the data on agricultural production, child anthropometry, and women and children's nutrition and health are still accurate and representative of the overall population, since it appears the omissions from the household roster data in June 2021 were likely

based on a different definition of household membership; individuals were not excluded from the roster in a systematic way that would introduce bias into the dataset.

4.2 SO1: Increased and Diversified Agricultural Production

4.2.1 Crop Production

Production and yield

The goal of diversified agricultural production was sustained and improved after exit, in terms of number of agricultural products (crop and livestock) produced, total production, and productivity per hectare. Between baseline and endline, the average number of products increased from 4.3 to 10.8, and that improvement continued, increasing to 13.5 different products by 2021. This being said, yield per crop did not increase for any of the crops for which detailed production data were collected. (See Table 1.) While calculation of yield per acre is challenging, the data are consistent in showing a decrease in yield per hectare for all crops measured (sorghum, cowpea, onion, tomato, rice). The declines observed in yield across all five crops may be partially explained by climate challenges, but other factors may include security concerns, consequent supply chain issues, access to financial resources to obtain quality inputs, and reduced adoption of good agricultural practices (GAPs). Additionally, observed decreases in yield of market garden and cash crops may be unreliable due to very small numbers of farmers planting these crops. For example, only ten farmers reported planting onions, nine planted tomatoes, and twenty-six planted rice at endline. With such small sample sizes, it is difficult to draw statistically sound conclusions about changes in yield.

Agricultural Production											
Code	Description	BL	EL	FU	Diff. EL-BL	Sig. EL-BL	Diff. FU-EL	Sig. FU-EL	N-BL	N-EL	N-FU
Strategic Objective 1: Increased and diversified agricultural production - crop yield for selected crops											
IM 1	# Ag. products	4.3	10.8	13.5	6.4	***	2.8	***	598	1008	2381
IM 2 - crop yield (kg / ha)	Sorghum	714.1	504.9	467.9	-209.2	***	-37.1	*	337	497	1808
	Cowpeas	208.8	305.3	270.5	96.5	***	-34.7	*	286	582	1840
	Onions	286.8	6646.3	2397.4	6359.5	***	-4248.9	***	31	10	188
	Tomatoes	n/a	2667.6	1544.2	n/a	n/a	-1123.4	Ns	n/a	9	93
	Rice	n/a	1059.5	683.6	n/a	n/a	-375.9	*	n/a	26	61
IR 1.1: Improved agricultural practices adopted - intercropping for specific crops											
OC 2 – Intercropping	Sorghum	20.5%	28.6%	8.7%	8.1%	ns	-19.9%	***	395	511	1825
	Cowpeas	20.9%	22.4%	8.8%	1.5%	***	-13.6%	***	387	606	1852
OC 1 – Improved practices	% of farmers using at least 4 good practices	75.1%	80.7%	52.3%	5.6%	ns	-28.4%	***	594	975	2364
IR 1.2: Improved input use - at least one of chemical / organic fertilization, improved seeds, and/or seed treatment on any crop											
OC 6 – Input use	% of farmers using at least one input	74.7%	78.2%	43.4%	3.6%	ns	-34.8%	***	580	932	2346

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 1: Agricultural production indicators

Other crops, such as cowpea and sorghum, were much more widely planted by farmers at both endline and follow-up. For example, production of the cash crop cowpea increased from 65 percent of farmers at endline to 75 percent at follow-up, and production of the subsistence crop sorghum also increased significantly from 55 to 75 percent of farmers between endline and follow-up. As mentioned above, the number of farmers producing the promoted market garden/cash crops was small, although these numbers did rise significantly for onions and tomatoes: 8% grew onions, 4% grew tomatoes, and 3% grew rice at follow-up, an increase from endline of 1.0, 0.9, and 2.6 percent, respectively, though overall percentages are still low. This shows that production of these promoted market garden/cash crops was far from widespread at endline, and increases between endline and follow-up were relatively small. In contrast, percent of farmers planting sesame and groundnuts, both cash crops, increased significantly, with a substantial proportion of farmers producing them at FU (see Figure 3).

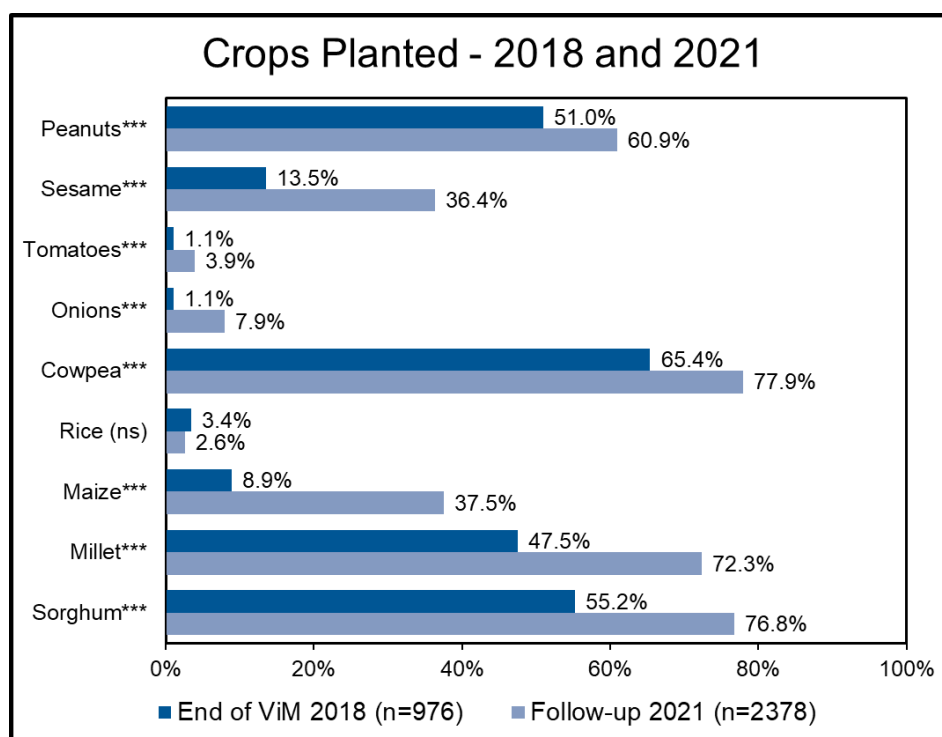


Figure 3: Percent of farmers growing specific crops at endline and follow-up

Use of some improved practices such as intercropping and thinning and reported use of one or more specific improved agricultural inputs (chemical/organic fertilization, improved seeds, and/or seed treatment) fell significantly from almost 80% to about 40% - a proportion much lower than the 75% of farmers reporting using such inputs at baseline. These specific inputs (asked about in baseline and endline, and therefore in or follow up) are different from the broad categories of equipment and materials distributed by ViM and mentioned in the executive summary as having improved in some cases between ViM endline and follow-up. The percent of farmers reporting using at least four sustainable crop or livestock practices, unchanged between ViM baseline and endline, fell from 81% to 52% by follow up (see Table 1 above). Nonetheless, when were farmers were asked about specific inputs and practices, some (mounds, zaï pits, manual tillage) did

increase, while others fell (see Figure 6), and use of a number of specific inputs did increase, as described below (see Figure 4).

The increased diversity of crops appears to have been driven by substantial increases in the percent of farmers growing sorghum, millet, maize, and cowpea; increased numbers of farmers also reported production of cash crops, including groundnuts, sesame, onions, and tomatoes, though the numbers for the latter two were still small (see Figure 3).

4.2.2 Livestock

About 65% of farmers at both endline and follow-up reported owning animals, though the overall number of animals owned decreased significantly for sheep/goats and pigs. The proportion of farmers reporting ownership of cows, sheep/goats, and poultry rose significantly between endline and follow-up, while the percentage reporting ownership of pigs declined (but was low at both time points). These data can be seen in Table 2 below – the data for types of animals owned was calculated as a percentage of all survey respondents, while the follow-up questions were only asked to the subset of respondents who indicated owning at least one livestock animal. Although the percentage of farmers vaccinating at least one animal dropped significantly from endline to follow-up (see Table 3), use of veterinary care and vaccinations in combination was unchanged during ViM and did not change at follow up either (40% at endline and 39% at follow-up – see Figure 5 below). Table 2 shows that access to inputs dropped significantly between endline and follow-up (31% to 21%), as did access to markets (48% to 33%); recordkeeping fell to negligible levels (17% to 1%). Joint purchase of vaccines and delayed sales, on the other hand, rose significantly between endline and follow-up, with 18% of farmers participating in joint purchases and 41% practicing delayed sales at follow-up. Sales through a producer group were quite rare at EL and remained so at FU.

Livestock Production Variables							
Category	Variable	EL	FU	Diff.	Sig.	N-EU	N-FU
Owns animals over which farmer makes decisions		65.0%	66.8%	1.8%	ns	1008	2377
Types of animals owned	Cattle	22.0%	31.9%	9.9%	***	1008	2376
	Sheep / Goats	56.4%	71.4%	14.9%	***	1008	2376
	Poultry	28.8%	52.3%	24.2%	***	1008	2376
	Pigs	3.9%	2.8%	-1.1%	*	1008	2376
Livestock management practices during last agricultural season	No livestock management practices	37.2%	35.6%	-1.5%	ns	659	1588
	Complementary feeding	26.4%	29.7%	3.3%	ns	659	1588
	Veterinary care	53.4%	50.9%	-2.5%	ns	659	1588
	Habitat construction	7.6%	11.9%	4.3%	***	659	1588
	Maintaining sex ratio	2.0%	0.5%	-1.5%	***	659	1588
	Control/regulation of production	1.1%	2.0%	0.9%	ns	659	1588
	Genetic improvement	1.7%	1.0%	-0.7%	ns	659	1588
Feeding practices during last agricultural season	No feeding practices	30.2%	34.9%	4.7%	**	659	1588
	Planting	8.4%	5.7%	-2.7%	**	659	1588
	Cut and stock	39.3%	32.8%	-6.5%	***	659	1588
	Natural fodder	55.7%	50.6%	-5.1%	**	659	1588

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Has adoption of livestock value chain practices improved the following situations?	Access to inputs	30.7%	21.4%	-9.3%	***	659	1588
	Access to financial services	7.9%	6.9%	-1.0%	ns	659	1588
	Access to markets	47.7%	33.3%	-14.3%	***	659	1588
	Joint purchase of vaccines	8.0%	17.5%	9.5%	***	659	1588
	Bulk sales through producer group	2.4%	1.8%	-0.6%	ns	659	1588
	Record keeping (production, inputs, sales)	16.7%	0.8%	-15.9%	***	659	1588
	Marketing skills (marketing, negotiation, calculations)	5.8%	0.1%	-5.7%	***	659	1588
	Delayed sales	34.3%	41.4%	7.1%	***	659	1588

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 2: Use of livestock management practices, feeding practices, and the farmer opinion of the impact of value chain practices

In disaggregated data by type of service, 81% of animal owners received some veterinary services. Of those, the percent receiving them from a village vaccinator (VTV) fell from 51% to 33%; the percent of those receiving vaccines from the VTVs also fell from 57% at endline to 37% at follow-up. Use of government services also declined, while use of private clinics and organizations increased. The overall rate of using veterinary services was maintained between endline and follow-up, while the percentage of farmers vaccinating at least one of their animals dropped slightly from 75% to 68%. Note in Table 3 below that the amount of money spent on veterinary services, medications, and vaccines dropped significantly between endline and follow-up despite the stable rate of use, while the amount spent on livestock inputs increased significantly from 2,700 to 9,331 CFA (constant value) francs.

The most commonly reported problems in animal husbandry at follow-up were livestock diseases and low availability of pasturelands, with 58% and 44% of farmers reporting these issues, respectively (no significant change from endline for either of these variables). Low quality or unavailability of animal feed remained at approximately 21% of farmers reporting, while reporting lack of water decreased significantly from 45% at endline to 15% at follow-up. This could reflect a decrease in reported drought and/or an increase in reported excess rainfall. Additionally, other programs in the zone were implementing water point interventions which may also have had an effect. Similarly, the percentage of farmers reporting drought and migration-related conflicts dropped significantly, while degeneration or unavailability of improved stock increased significantly from 2% at endline to (still low) 9% at follow-up.

Veterinary services, vaccines, and challenges faced in animal husbandry							
Category	Variable	EL	FU	Dif.	Sig.	N-EU	N-FU
Vet services	Needed vet. services last season	63.4%	69.3%	5.8%	***	659	1588
	Received veterinary services	81.1%	81.6%	0.5%	Ns	417	1100
From whom did you receive veterinary services?	Ministry of Agriculture (MAAH)	63.0%	49.8%	-13.2%	***	338	897
	Private veterinary clinic	3.3%	9.7%	6.4%	***	338	897
	Non-government organization	0.9%	7.0%	6.1%	***	338	897
	Community-based organization	10.4%	0.1%	-10.2%	***	338	897
	Volunteer Village Vaccinator (VTV)	50.6%	32.7%	-17.9%	***	338	897

Veterinary services, vaccines, and challenges faced in animal husbandry							
Category	Variable	EL	FU	Dif.	Sig.	N-EU	N-FU
	Producers' organization	n/a	3.7%	n/a	n/a	n/a	897
	Friend/neighbor/parent	15.1%	7.5%	-7.6%	***	338	897
	Private organization	0.9%	5.6%	4.7%	***	338	897
	Other government organization	12.4%	n/a	n/a	n/a	338	n/a
Vaccines	1+ animals vaccinated last season	75.3%	68.4%	-6.9%	***	659	1588
From whom did you receive vaccines?	I purchased and administered vaccines	n/a	7.9%	n/a	n/a	n/a	1053
	Ministry of Agriculture (MAAH)	47.8%	48.1%	0.3%	Ns	496	1053
	Private veterinary clinic	3.4%	7.7%	4.3%	***	496	1053
	Non-government organization	0.4%	6.1%	5.7%	***	496	1053
	Community-based organization	8.3%	0.1%	-8.2%	***	496	1053
	Volunteer Village Vaccinator (VTV)	57.1%	36.5%	-20.6%	***	496	1053
	Producers' organization	n/a	1.3%	n/a	n/a	n/a	1053
	Friend/neighbor/parent	12.5%	6.3%	-6.2%	***	496	1053
	Private organization	1.2%	7.0%	5.8%	***	496	1053
Other government organization	8.7%	n/a	n/a	n/a	496	n/a	
Amount paid for services	FCFA paid for vet services last season	5281	2225	-3056	***	335	1588
	FCFA paid for medications last season	2367	1988	-379	Ns	657	1588
	FCFA much paid for vaccines last season	3589	1499	-2090	***	495	1588
	FCFA paid for livestock inputs last season	2700	9331	6631	***	657	1588
Challenges faced in livestock raising activities over the course of the last year	No difficulties faced	13.5%	13.5%	0.0%	Ns	659	1588
	No expertise in animal husbandry	14.9%	15.1%	0.2%	Ns	659	1588
	Improved stock degenerated/unavailable	1.5%	9.01%	7.5%	***	659	1588
	Poor quality/unavailable animal health products	4.9%	18.0%	13.2%	***	659	1588
	Poor quality/unavailable animal feed	23.5%	21.2%	-2.4%	Ns	659	1588
	Low availability of pasture	46.6%	43.9%	-2.7%	Ns	659	1588
	Low availability of land	21.9%	11.6%	-10.3%	***	659	1588
	Migration-related conflicts	22.0%	7.6%	-14.5%	***	659	1588
	Lack of water	44.5%	15.2%	-29.2%	***	659	1588
	Taxes are too high	0.9%	0.2%	-0.7%	**	659	1588
	Livestock diseases, contamination, pandemics	54.8%	57.9%	3.2%	Ns	659	1588
	Floods	0.5%	3.6%	3.1%	***	659	1588
	Drought	19.1%	2.4%	-16.7%	***	659	1588
Lack of markets / lack of buyers	n/a	2.3%	n/a	n/a	n/a	1588	

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 3: Use of veterinary services, use of vaccines, and challenges faced in animal husbandry by animal agriculture farmers

4.2.3 Use of Inputs

ViM subsidized agricultural inputs during the life of the program, and these subsidies did not continue once the program ended. Use of many agricultural inputs still did increase, however. At follow up, there was a substantial increase in the use of agricultural equipment for labor, seeds, weeding, harvesting, and transportation, with between 15% and 21% of farmers using these at follow up (see Figure 4). ViM organized input fairs to connect farmers with input suppliers and provided subsidies for various products; these fairs and subsidies ended at the conclusion of the program in 2018 (as reported in the qualitative investigation), but use of improved seeds and fertilizer also showed substantial increase from endline to follow-up, with 43% using improved seeds and 65% using fertilizer. Almost all farmers (92%) reported using at least one of these improved inputs at follow up. Almost no one reported using storage infrastructure – a focus of ViM – at follow up (data not collected at endline).

In terms of livestock, poultry vaccines were used by 36% of farmers at follow up, and almost half used vaccines for other livestock. Use of improved livestock feed rose from 5% use at endline to 21% of farmers at follow up (see Figure 4).

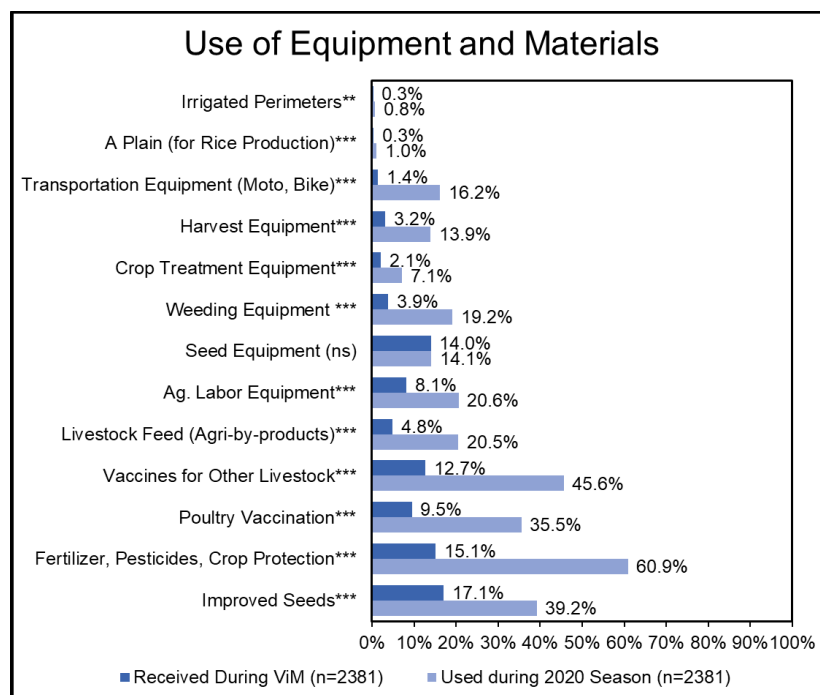


Figure 4: Use of agricultural equipment and inputs at endline and follow-up

Few farmers used veterinary care, improved storage, and animal habitat construction at the same time whether at baseline, endline, or follow up, but use of veterinary care was maintained (see Figure 5). The source of veterinary services changed, however, with a decline in the percent using VVVs from 51% to 33%, and an increase in the use of private veterinary clinics or other private organizations (see Table 3).

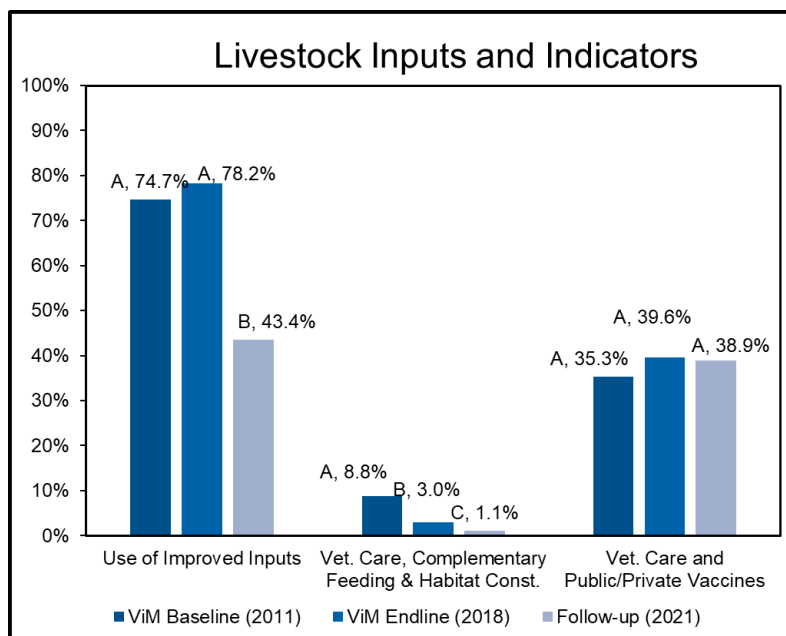


Figure 5: Use of veterinary care at baseline, endline, and follow-up

4.2.4 Use of Practices

Among the practices promoted by the program, across the five crops measured (sorghum, rice, cowpea, onion, tomato), use of plowing and zaï pits was unchanged, and use of mounds and manual tillage increased for the major crops, but most other practices, including line planting, weeding, and thinning declined (see Figure 6). In the qualitative discussions, farmers reported continuing to use practices that were cost-free and did not require groups to work together, certainly the case for mounds and zaï pits (in contrast to more costly inputs like chemical fertilizer and seed and plant treatment).

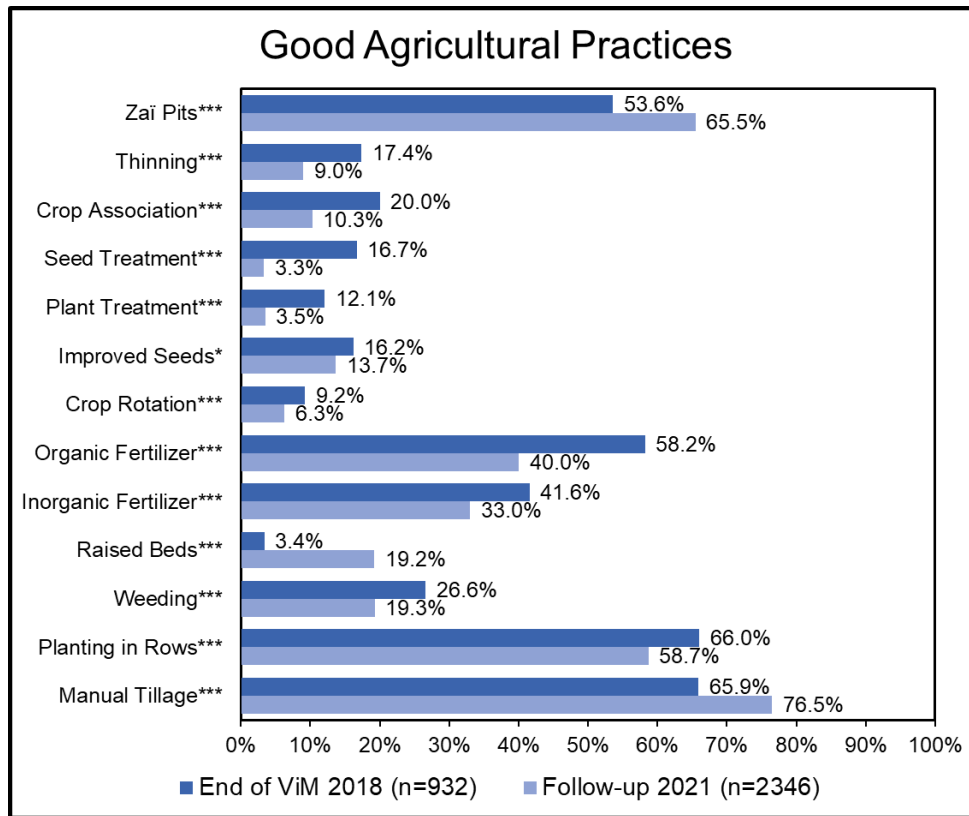


Figure 6: Use of GAPs and NRM practices at ViM endline and follow-up surveys

Multivariate regressions on factors influencing continued use of these practices at follow-up reveal a nuanced relationship. Being a member of a producer association is strongly associated with increased probability of taking up practices such as row planting, weeding, mound construction, thinning, and use of inputs such as chemical fertilizer, improved seeds, and seed treatment (though not of organic fertilizer, zai pits, plant treatment, or crop association). This suggests that there are benefits to be derived from participating in producer organizations, although further research is needed to determine how long it takes for these PO models to be fully absorbed into standard practice. Indicators of wealth, including land cultivated, domestic asset ownership, total number of crops planted, and number of livestock types owned were also positively associated with adoption of many practices. Attending trainings specific to a given practice also increased the likelihood of adopting that practice (for example, attending plant production trainings increased likelihood of adopting chemical fertilizer and crop association). Experiencing terrorism, whether in the community, in markets, or on roadways, was negatively associated with the adoption of several practices. Being female is also negatively associated with the adoption of certain practices, including zai pits, row planting, weeding, and mound construction. This could be due to differences in access to land or in land tenure between men and women which would influence the nature of cropping systems as well as differences in access to labor and other necessary resources. Results of the multivariate analysis are shown in Table 4.

Adoption of agricultural and environmental practices

VARIABLES	Manual Tillage	Row Planting	Weeding	Mound Construction	Chemical Fertilizer	Organic Fertilizer	Crop Rotation
Producer association member	0.047* (0.028)	0.099*** (0.036)	0.055** (0.026)	0.110*** (0.023)	0.081** (0.033)	0.040 (0.039)	0.024* (0.013)
Farmer age	0.001 (0.001)	-0.002* (0.001)	-0.001 (0.001)	-0.001* (0.001)	-0.003*** (0.001)	-0.002** (0.001)	0.000 (0.000)
Farmer is female	-0.009 (0.025)	-0.126*** (0.033)	-0.082*** (0.027)	-0.060* (0.031)	-0.031 (0.039)	-0.024 (0.037)	-0.001 (0.017)
Total land area in ha (5 crops)	0.022** (0.011)	0.061*** (0.012)	0.003 (0.007)	-0.003 (0.007)	0.021** (0.010)	0.026** (0.012)	-0.003 (0.003)
Domestic asset ownership index	0.001 (0.006)	-0.012 (0.008)	0.011** (0.005)	0.003 (0.006)	0.006 (0.006)	0.004 (0.005)	0.012*** (0.004)
Number of crops planted	0.081*** (0.008)	0.001 (0.011)	-0.030*** (0.007)	0.000 (0.009)	0.016 (0.012)	0.002 (0.015)	0.010** (0.004)
Number of livestock types	0.022* (0.011)	0.017 (0.014)	0.030*** (0.009)	0.039*** (0.013)	0.061*** (0.014)	0.061*** (0.014)	-0.000 (0.005)
Number of household members	-0.005 (0.003)	-0.011** (0.005)	-0.001 (0.003)	0.007** (0.003)	0.001 (0.004)	-0.001 (0.004)	0.000 (0.002)
Experienced terrorism	-0.077** (0.031)	-0.132*** (0.046)	-0.105*** (0.035)	0.042 (0.046)	-0.118*** (0.042)	-0.097** (0.038)	0.001 (0.014)
Received labor equipment	-0.062 (0.039)	-0.011 (0.038)		-0.003 (0.024)	-0.061* (0.036)	-0.103*** (0.032)	-0.059*** (0.015)
Plant production training	0.002 (0.042)	-0.013 (0.065)	0.078* (0.041)	0.074* (0.040)	0.133*** (0.045)	0.094* (0.052)	-0.006 (0.024)
Value chain training (crops)	-0.050 (0.051)	0.200*** (0.054)	0.006 (0.043)	-0.013 (0.040)	-0.080* (0.047)	-0.131** (0.061)	0.017 (0.026)
Farming as a Business training	-0.196 (0.143)	0.090 (0.229)	0.020 (0.115)	-0.272** (0.111)	-0.138 (0.183)	0.069 (0.172)	
Received weeding equipment			-0.184*** (0.028)				
Natural resource training						0.123** (0.051)	-0.057*** (0.020)
Received seeding equipment							
Received crop treatment equip.							
Observations	2,343	2,343	2,343	2,343	2,343	2,343	2,333
Pseudo R-squared	0.123	0.0755	0.0895	0.0524	0.0561	0.0466	0.0755
Actual Probability	0.765	0.586	0.193	0.192	0.330	0.400	0.0630
Predicted Probability	0.796	0.595	0.167	0.180	0.320	0.395	0.0490

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients represent marginal effects of independent variables on the outcome variable at the mean values of each variable.

Adoption of agricultural and environmental practices (continued)

VARIABLES	Improved Seeds	Plant Treatment	Seed Treatment	Crop Association	Thinning	Zai Pits
Producer association member	0.058*** (0.019)	0.006 (0.008)	0.024*** (0.007)	0.024 (0.016)	0.036** (0.017)	0.018 (0.035)
Farmer age	-0.001*** (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.002* (0.001)
Farmer is female	0.015 (0.020)	0.001 (0.008)	-0.012 (0.011)	-0.028 (0.020)	-0.020 (0.015)	-0.097*** (0.030)
Total land area in ha (5 crops)	0.017*** (0.004)	0.003* (0.002)	0.004** (0.002)	-0.017*** (0.006)	-0.000 (0.004)	0.096*** (0.013)
Domestic asset ownership index	0.009** (0.004)	0.000 (0.002)	0.001 (0.001)	0.011** (0.005)	0.009** (0.004)	-0.012** (0.006)
Number of crops planted	0.015*** (0.005)	0.008*** (0.002)	0.003 (0.002)	0.019*** (0.005)	0.012*** (0.004)	0.023** (0.011)
Number of livestock types	0.021*** (0.007)	0.005 (0.003)	0.005* (0.003)	0.012 (0.008)	0.024*** (0.008)	0.017 (0.014)
Number of household members	-0.003 (0.003)	-0.000 (0.001)	0.000 (0.001)	-0.000 (0.002)	-0.002 (0.002)	-0.004 (0.004)
Experienced terrorism	-0.024 (0.027)	-0.004 (0.011)	0.011 (0.013)	0.052** (0.022)	0.029 (0.022)	-0.010 (0.038)
Received labor equipment				-0.051*** (0.020)	-0.050*** (0.016)	-0.050 (0.041)
Plant production training	-0.030 (0.026)	0.021* (0.011)	0.005 (0.011)	0.065** (0.028)	-0.001 (0.027)	-0.017 (0.053)
Value chain training (crops)	0.024 (0.027)	0.009 (0.012)	-0.025 (0.018)	-0.069 (0.044)	-0.138** (0.064)	-0.043 (0.057)
Farming as a Business training	0.020 (0.106)	-0.030 (0.033)	0.025 (0.040)	0.018 (0.110)	0.093 (0.097)	-0.065 (0.141)
Received weeding equipment						
Natural resource training	0.146*** (0.028)	0.015 (0.010)	0.002 (0.009)	-0.115*** (0.029)	-0.075** (0.033)	0.021 (0.053)
Received seeding equipment	-0.094*** (0.025)		-0.007 (0.010)			
Received crop treatment equip.		0.024* (0.014)				
Observations	2,343	2,343	2,343	2,343	2,343	2,343
Pseudo R-squared	0.118	0.100	0.0582	0.0924	0.0877	0.105
Actual Probability	0.137	0.0341	0.0333	0.103	0.0905	0.656
Predicted Probability	0.111	0.0244	0.0270	0.0795	0.0694	0.677

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients represent marginal effects of independent variables on the outcome variable at the mean values of each variable.

Table 4: Regression tables showing factors associated with adoption of GAP and NRM practices targeted by the ViM program at follow-up

4.2.5 Results by Gender

There were notable differences in these results by gender. Women farmers reported producing fewer different types of crops than men: 9 types, compared with 15 for men. Use of sustainable practices was also significantly lower among women at 36% compared with 56% for men, and a similar result was seen for reported use of improved inputs when this question was posed in a general way, that is, not by specific input type (35% of women farmers versus 45% for men). Reasons for this difference remain to be determined, since there was no observed difference by gender in the use of financial services, pricing information, or participation in value chains. Some of the gendered differences found in use of GAPs and NRM practices and access to agricultural inputs could be tied to inequalities in division of workload between members of a household, differences in decision-making power on what crops to grow or what inputs to use, and differential in investing limited household resources favoring plots owned and managed by men.

Farming practices by gender at follow-up						
Indicator	Male	Female	Diff.	Sig.	N-male	N-female
Average number of different types of agricultural products produced per farmer	14.6	9.0	5.7	***	1920	460
Percentage of farmers who used at least 4 sustainable ag. (crop / livestock / NRM) practices/technologies in the most recent season	56.2%	36.0%	20.3%	***	1908	456
Percentage of farmers using improved agricultural inputs	45.3%	35.5%	9.8%	***	1898	448
Percentage of farmers who used financial services in the most recent season	13.8%	11.6%	2.2%	Ns	1920	458
Percentage of farmers reporting access to up-to-date pricing information	55.6%	60.4%	-4.9%	Ns	340	91
Percentage of farmers who practiced in at least 1 value chain activity promoted by the program in the most recent season (crops only)	32.9%	30.8%	2.2%	Ns	1815	403

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 5: Farming practices by gender at follow-up

4.2.6 ViM Sustainability Strategies

4.2.6.1 Producer Organizations and Marketing Services

One of the key sustainability strategies implemented by ViM was to establish or strengthen producer organizations (POs) that would participate in collective marketing and input purchasing. The program intended to help these POs obtain legal recognition and link them to local government or local implementing partners (LIPs) to support their continuation. Corroborating findings from the qualitative study, membership in producer associations fell between endline and follow-up across the board. Membership in producer associations at endline was high for cowpea farmers but fell dramatically from 55% to under 14% by follow up. Membership in producer associations for cash crops (tomatoes, onions), for which the benefits should have been greater, also fell, though

not significantly since membership was not high to begin with (see Table 6). Among farmers growing each crop, the percent of those engaging in joint (group) purchases of inputs or transport or in group sales at endline did not exceed 10% except for rice, where 18% of the (few) rice farmers purchased inputs jointly. At follow up, fewer than four percent of farmers of any crop engaged in joint sales, a key sustainability strategy for ViM. That said, joint purchases and sales for any crop did not exceed 10% of farmers at EL, and the decline at FU was not significant. Among those with livestock, however, the percent reporting joint purchases of vaccines increased significantly. This is an important finding, as results from qualitative research findings show that VVVs often had to discard excess vaccines, as they could only be purchased in bulk vials, and the level of demand at the village level was not high enough to use up the entire vial. Joint purchases of vaccines could be a way to address these supply chain issues.

Producer organizations, joint purchases, and joint sales							
Variable Type	Producer org.	EL	FU	Diff.	Sig.	N-EL	N-FU
Membership in producer associations	Cowpea	54.91%	13.75%	-41.16%	***	224	2378
	Sorghum	18.75%	n/a	n/a	n/a	224	2378
	Tomato	1.79%	1.22%	-0.57%	ns	224	2378
	Onion	5.80%	3.74%	-2.06%	ns	224	2378
	Ruminants	11.61%	2.35%	-9.25%	***	224	2378
	Poultry	1.79%	2.14%	0.36%	ns	224	2378
Joint purchase of inputs	Sorghum	6.85%	7.84%	0.99%	ns	511	1825
	Rice	9.68%	18.03%	8.36%	ns	31	61
	Cowpea	7.43%	6.53%	-0.89%	ns	606	1852
	Onion	10.00%	9.04%	-0.96%	ns	10	188
	Tomato	10.00%	3.23%	-6.77%	ns	10	93
Joint sales of produce	Sorghum	1.17%	1.21%	0.03%	ns	511	1825
	Rice	3.23%	0.00%	-3.23%	ns	31	61
	Cowpea	2.31%	1.40%	-0.91%	ns	606	1852
	Onion	10.00%	2.66%	-7.34%	ns	10	188
	Tomato	10.00%	4.30%	-5.70%	ns	10	93

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 6: Farmer membership in producer organizations and participation in joint purchase of inputs and joint sales of farm produce at endline and follow-up

Similarly, the percent of farmers using financial services, which was unchanged during ViM, fell from 31% to 13% by follow up; those engaged in value chain activities fell from 57% to 33%. Those accessing up to date pricing information, which was made available during the program, fell from 83% at endline almost to its baseline of level of 57% at follow up (see Figure 7 below).

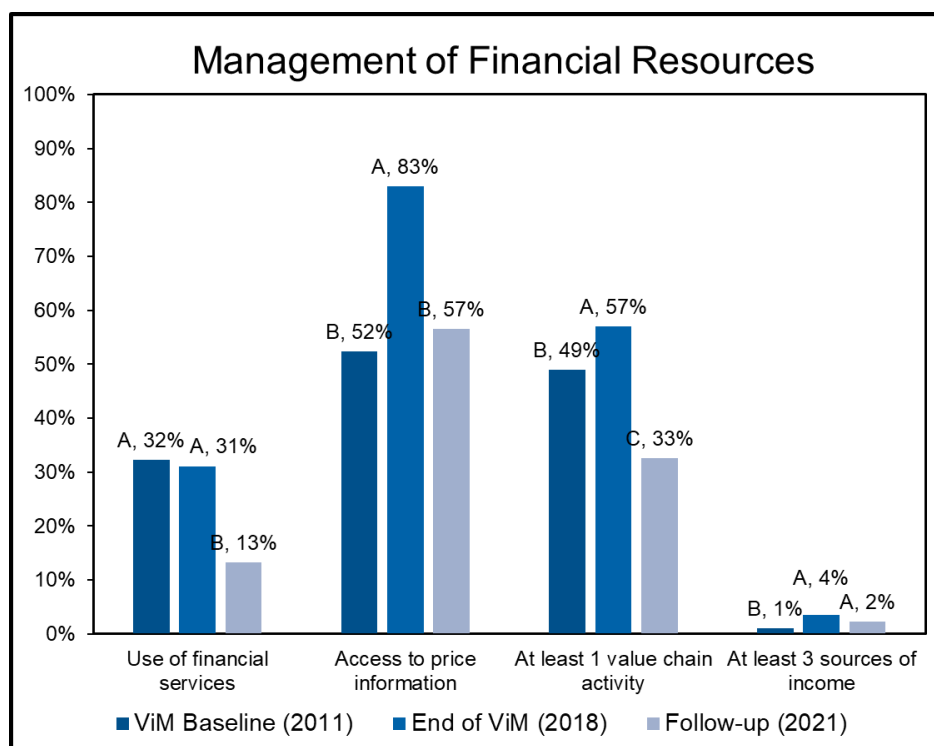


Figure 7: Farmer use of financial services

Regressions showing the association between various farmer and farm characteristics and membership in producer associations (results shown in Table 7 below) show that having more land, more domestic assets, and planting key crops / owning key livestock types targeted by the associations were all associated with increased likelihood of membership. Many of these characteristics are likely to be held by the man of the household as opposed to the women, given the gendered and unequal access to assets and inputs characteristic of most communities in the zone of intervention. Experiencing terrorism was not associated with membership, though in the qualitative investigation, farmers said they found it difficult to travel to group meetings due to security concerns. Overall membership in associations was low for market garden crops and livestock at both endline and follow up; it was low at endline for all crops except cowpea and declined or remained low at follow-up for other crops (see Table 6 above).

Factors Affecting Membership in Producer Organizations

VARIABLES	Any association	Any association	Any association	Cowpea	Onion	Tomato	Sheep / goats	Poultry
Farmer age	0.001* (0.001)	0.000 (0.001)	0.001 (0.001)	0.001** (0.001)	-0.000 (0.000)	0.000** (0.000)	0.000 (0.000)	0.000 (0.000)
Farmer is female	0.047** (0.022)	0.062*** (0.022)	0.048** (0.022)	0.029 (0.020)	0.003 (0.005)	0.001 (0.003)	0.000 (0.009)	0.002 (0.005)
Total land (ha)	0.014** (0.005)	0.021*** (0.006)	0.024*** (0.005)					
Dom. asset index	0.012** (0.005)	0.013*** (0.005)	0.015*** (0.004)	0.007 (0.004)	0.002* (0.001)	0.001*** (0.000)	0.001 (0.001)	0.003** (0.001)

Factors Affecting Membership in Producer Organizations

VARIABLES	Any association	Any association	Any association	Cowpea	Onion	Tomato	Sheep / goats	Poultry
Planted cowpea	0.089*** (0.029)			0.108*** (0.028)				
Planted onions	0.210*** (0.029)				0.070*** (0.014)			
Planted tomatoes	-0.027 (0.050)					0.019** (0.008)		
Own sheep/goat	0.047** (0.021)						0.032*** (0.010)	
Own poultry	0.048*** (0.018)							0.020*** (0.005)
# HH members	0.004 (0.003)	0.005* (0.003)	0.006* (0.003)	0.003 (0.002)	-0.000 (0.001)	0.000 (0.000)	0.001* (0.001)	-0.000 (0.001)
Terrorism	-0.005 (0.027)	0.004 (0.028)	0.003 (0.027)	-0.012 (0.026)	0.000 (0.007)	-0.001 (0.002)	-0.008 (0.006)	-0.000 (0.007)
# Crops		0.010 (0.006)						
# Livestock types		0.042*** (0.009)						
Planted any crops			0.191** (0.081)					
Owned livestock			0.078*** (0.021)					
Cowpea hectares				0.011 (0.009)				
Onion hectares					-0.001 (0.003)			
Tomato hectares						0.000 (0.001)		
Observations	2,373	2,416	2,416	2,375	2,375	2,375	2,373	2,373
Pseudo R-squared	0.0628	0.0428	0.0381	0.0298	0.389	0.356	0.0502	0.0395
Actual Probability	0.196	0.193	0.193	0.197	0.197	0.197	0.196	0.196
Predicted Probability	0.182	0.183	0.182	0.129	0.0131	0.00327	0.0178	0.0180

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients represent marginal effects of independent variables on the outcome variable at the mean values of each variable.

Table 7: Factors associated with membership in producer organizations at follow up

Multivariate regression analysis was also conducted on marketing of agricultural products to examine what factors are associated with increased or decreased likelihood of participating in market-based production. Regression results (Table 8) show that being a member of a producer association was, not surprisingly, associated with increased likelihood of selling produce, as was

having more domestic assets, planting cash crops (rice, onions, and tomatoes), and owning cows and poultry. In these results, women farmers were more likely than men to sell crops.

Factors Affecting Marketing of Agricultural Products

VARIABLES	Sold any products	Sold any products	Sold any products	Sold crops	Sold animal products
Producer association member	0.090** (0.035)	0.151*** (0.037)	0.169*** (0.034)		
Farmer age	-0.000 (0.001)	-0.001* (0.001)	-0.001 (0.001)	-0.002** (0.001)	-0.001 (0.001)
Farmer is female	0.045 (0.031)	0.065** (0.031)	0.028 (0.032)	0.087*** (0.028)	0.029 (0.029)
Total land area in ha (5 crops)	-0.012 (0.008)	-0.001 (0.008)	0.004 (0.008)	0.014** (0.007)	
Domestic asset ownership index	0.024*** (0.007)	0.025*** (0.007)	0.034*** (0.007)	0.027*** (0.006)	0.006 (0.007)
Planted cowpea last season	0.042 (0.034)				
Planted sorghum last season	-0.051 (0.037)				
Planted rice last season	0.228*** (0.065)				
Planted onions last season	0.540*** (0.065)				
Planted tomatoes last season	0.454*** (0.159)				
Had sheep or goats	0.274*** (0.028)				
Had pigs	0.091 (0.066)				
Had cows	0.089*** (0.029)				
Had poultry	0.222*** (0.027)				
Number of household members	0.009** (0.005)	0.012*** (0.004)	0.014*** (0.005)	0.005 (0.003)	0.013*** (0.004)
Experienced terrorism	0.042 (0.033)	0.053 (0.036)	0.043 (0.037)	-0.020 (0.045)	0.103*** (0.032)
Total number of crops planted		0.011 (0.011)		0.050*** (0.010)	
Number of livestock types		0.194*** (0.016)			0.298*** (0.015)
Planted any crops			0.361*** (0.080)		
Owned any livestock			0.441*** (0.038)		

Factors Affecting Marketing of Agricultural Products

VARIABLES	Sold any products	Sold any products	Sold any products	Sold crops	Sold animal products
Member of a crop association				0.179*** (0.028)	
Member of a livestock association					0.117* (0.062)
Observations	2,373	2,416	2,416	2,416	2,416
Pseudo R-squared	0.195	0.149	0.138	0.0864	0.237
Actual Probability	0.577	0.567	0.567	0.273	0.456
Predicted Probability	0.613	0.577	0.564	0.255	0.431

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients represent marginal effects of independent variables on the outcome variable at the mean values of each variable. The first three regressions have the same dependent variable, “sold any products”. The difference lies in the differing combination of explanatory and control variables.

Table 8: Factors associated with marketing or agricultural products at follow-up

The biggest change in reported financial activity was in sale of crops or livestock, which fell from 55% of farmers at endline to 18% at follow up. Fewer farmers engaged in agricultural sales at follow up, though there was no decline in the percent of farmers reporting crop sales as their main revenue source (~34% at both time points), and the percent reporting sales of livestock as their main revenue source increased significantly (from 22% to 37%). These results are somewhat perplexing when considering that usage of certain equipment and materials went up between endline and follow-up. However, since these questions were on broad categories of materials and equipment, it is possible that use of these materials does not directly impact scaling up marketable yields. Rising food insecurity due to climate change, the IDP crisis in Kaya, and other factors may also be influencing farm households to save a larger portion of their harvests for home consumption. Those reporting at least 3 different sources of revenue, a goal of the program, remained very low from ViM baseline in 2012 through ViM Endline in 2018 to the follow-up survey in 2021 (see Table 9). However, the value of purchases from smallholders with US government assistance, which increased from 33,240 West African CFA Francs (XOF) at baseline to 63,078 XOF at endline (not statistically significant), further increased to 97,952 XOF at follow-up, which was a statistically significant increase (all amounts converted to December 2018 XOF for comparability).

Sources of Revenue							
Variable Type		EL	FU	Diff.	Sig.	N-EL	N-FU
Sources of revenue	Selling crops	33.20%	34.19%	0.99%	ns	985	2378
	Selling livestock	21.52%	37.26%	15.74%	***	985	2378
	Selling other livestock products	n/a	1.14%	n/a	n/a	n/a	2378
More than 3 sources of income		3.55%	2.35%	-1.20%	***	985	2378

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 9: Sources of revenue at endline and follow-up

ViM provided radio broadcasts with price information; the qualitative investigation found the plan to transfer responsibility for these broadcasts to local groups was not implemented. The main source of information on pricing at both endline and follow up was other farmers, used by over 50%; the use of radio broadcasts as an information source fell from 9% (EL) to 2% at follow up.

4.2.6.2 *Training*

The receipt of training in several domains related to production fell between endline and follow up; most notably farmers reporting training in plant production fell from 19% to 8%; training on livestock production was unchanged at about 7%, and in natural resource management unchanged at 11 – 12%. Other production-related training (value chains, farming as a business, financial management) was either unchanged or declined, but from only about 5% or less at EL. Farmers reporting training in areas unrelated to agricultural production, such as health, nutrition, sanitation, and gender equity also declined significantly from EL to FU (see Table 10).

Several compounding factors could be affecting the availability of trainings in Kaya. Due to heightened insecurity in the area, there are likely fewer development programs working in the area – often a key source of training programs. Another reason could be a lack of sustainability among community-based worker (CBW) roles established during ViM. As part of the sustainability strategy, ViM endeavored to catalyze continued training for farmers post-program by establishing the community-based worker (CBW) roles of endogenous trainers (lead farmers) and village vaccinators (VVs). Producer leaders were expected to continue providing training to farmers in their area on a volunteer basis – without remuneration. We found that only 25% of farmers reported knowing a ViM-trained producer leader at follow-up. Of those that knew one, though, 78% reported receiving training or technical assistance in the last agricultural season. While the number of producer leaders or awareness of them was low, among those still working, there was a high rate of support. VV's were trained to provide basic veterinary services and administer vaccines to livestock on a fee-for-service basis, establishing their own business. Similar to producer leaders, about 28% of farmers reported knowing a VV, and of these, 73% reported receiving training or other support. For both producer leaders and VVs, it appears that some of those trained during ViM may have reduced or ceased certain activities, or are no longer living in Kaya municipality due to having passed away or moved to another zone. The result is an overall decrease of the number of these CBWs in Kaya, although many service providers are still in Kaya and are continuing to provide their services to the population. Another potential compounding factor is that farmers may not always know whether a given service provider was trained by ViM or another entity.

4.2.7 *Challenges and Constraints*

Producers were asked about the challenges they faced in production and marketing of their crops and livestock. Although women were not asked specific questions about gender inequality in agricultural production and marketing during the survey, there is likely a significant gender dimension to agricultural production and marketing of produce. Between EL and FU, the percent reporting drought as a challenge fell significantly while those reporting flood rose. Those citing insecurity as a constraint to marketing rose from zero to over 5% for most crops, but insecurity was cited by 14% of onion producers and 26% of tomato producers, representing the major cash crops promoted by ViM. Those citing Covid restrictions rose from zero to only about 1 – 2%. Among livestock producers, the percent of farmers reporting migration related conflicts or low land or water availability as a production constraint fell significantly from EL (22%, 22%, and

44% respectively) to FU (8%, 11%, and 15% respectively), reflecting (in the case of water) the shift in climatic concerns from drought at EL to flooding at FU, and suggesting (in the case of land) that access to land was maintained despite the influx of migrants.

4.2.8 Receipt of Training and Services During and After Exit

In order to distinguish direct beneficiaries from non-beneficiaries at endline, the survey asked respondents what training and other resources they had received in the course of the ViM program. These same questions were posed to respondents at follow up, specifically with respect to training and services received since 2018, the time of program exit. Table 10 shows the results of those questions. Receipt of training in all domains reported at the household level fell to virtually negligible levels. The only training domains reported by more than one percent of respondents were agricultural (4.1%), natural resource management (2.1%) and livestock (1.1%) training. Responses at the individual farmer level showed a similar pattern: receipt of all types of training fell to under five percent in all categories.

Receiving trainings, inputs, and equipment during and after the ViM program										
Category	Training	Endline	FU - recall	Diff. (EL vs. recall)	Sig.	FU since 2018	Diff. (since 2018)	Sig.	N-EL	N-FU
Trainings and activities received by household from ViM program during 2011-2018 period	Agricultural training	35.2%	19.8%	-15.4%	***	4.1%	-31.2%	***	622	2242
	Livestock training	11.7%	5.8%	-5.9%	***	1.1%	-10.6%	***	622	2242
	Women's health and nutrition training	51.3%	7.7%	-43.6%	***	0.8%	-50.5%	***	622	2242
	Child health and nutrition training	58.7%	9.2%	-49.4%	***	0.9%	-57.8%	***	622	2242
	WASH activities	62.4%	9.5%	-52.9%	***	1.2%	-61.1%	***	622	2242
	SILC activities	15.1%	1.2%	-13.9%	***	0.1%	-15.0%	***	622	2242
	Gender inequality training	24.0%	1.7%	-22.2%	***	0.2%	-23.7%	***	622	2242
	Natural resources management training	34.4%	6.1%	-28.3%	***	2.1%	-32.4%	***	622	2242
	Radio mass communication training	n/a	0.6%	n/a	n/a	0.2%	n/a	n/a	622	2242
	Radio listening posts	n/a	1.2%	n/a	n/a	0.4%	n/a	n/a	622	2242
	Other trainings	1.1%	n/a	-1.1%	n/a	n/a	n/a	n/a	622	2242
	Received any training	74.9%	29.3%	-45.7%	***	6.4%	-68.5%	***	622	2242
	Total trainings received	2.9	0.6	-2.3	***	0.1	-2.8	***	622	2242
	Received rations from ViM	60.6%	37.1%	-23.5%	***	37.1%	-23.5%	***	622	2242
	Received rations after ViM	n/a	5.3%	n/a	n/a	5.3%	n/a	n/a	622	2242
	Total categories of rations received	1.2	0.6	-0.6	***	59.0%	-60.9%	***	622	2242
	Received either rations or training	81.0%	49.2%	-31.9%	***	10.7%	-70.4%	***	622	2242
	Received both rations and training	54.5%	17.9%	-36.6%	***	1.1%	-53.4%	***	622	2242
Individual farmer	Received crop inputs	16.9%	70.7%	53.9%	***	67.2%	50.3%	***	1008	2381
	Received livestock inputs	1.1%	55.0%	53.9%	***	52.0%	50.9%	***	1008	2381

QUANTITATIVE FINDINGS FROM THE SECOND PHASE OF A MIXED METHODS STUDY ON THE SUSTAINABILITY OF THE ViM PROGRAM IN KAYA, BURKINA FASO

Receiving trainings, inputs, and equipment during and after the ViM program										
Category	Training	Endline	FU - recall	Diff. (EL vs. recall)	Sig.	FU since 2018	Diff. (since 2018)	Sig.	N-EL	N-FU
reporting of participation	Value chain trainings (any)	5.6%	6.1%	0.5%	ns	1.5%	-4.1%	***	1008	2381
	Financial trainings (any)	5.9%	1.3%	-4.5%	***	0.5%	-5.4%	***	1008	2381
	Received equipment (any)	10.1%	36.0%	25.8%	***	33.1%	22.9%	***	1008	2381
	Received land (any)	3.2%	1.8%	-1.4%	**	1.5%	-1.7%	***	1008	2381
	Received non-ViM support	2.7%	26.8%	24.1%	***	26.8%	24.1%	***	1008	2381
	Crop beneficiary (any)	28.2%	80.7%	52.5%	***	76.5%	48.3%	***	1008	2381
	Livestock beneficiary (any)	6.9%	55.8%	48.8%	***	52.1%	45.1%	***	1008	2381
	Business training beneficiary (any)	6.3%	1.5%	-4.8%	***	0.5%	-5.7%	***	1008	2381
	GAP trainings (any)	22.4%	17.7%	-4.7%	***	5.1%	-17.3%	ns	1008	2381
	Livestock trainings (any)	7.0%	7.9%	0.9%	ns	2.7%	-4.4%	**	1008	2381
	GAP or livestock trainings	23.7%	20.5%	-3.3%	**	6.6%	-17.2%	ns	1008	2381

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 10: Participation in ViM-targeted activities during and after the program

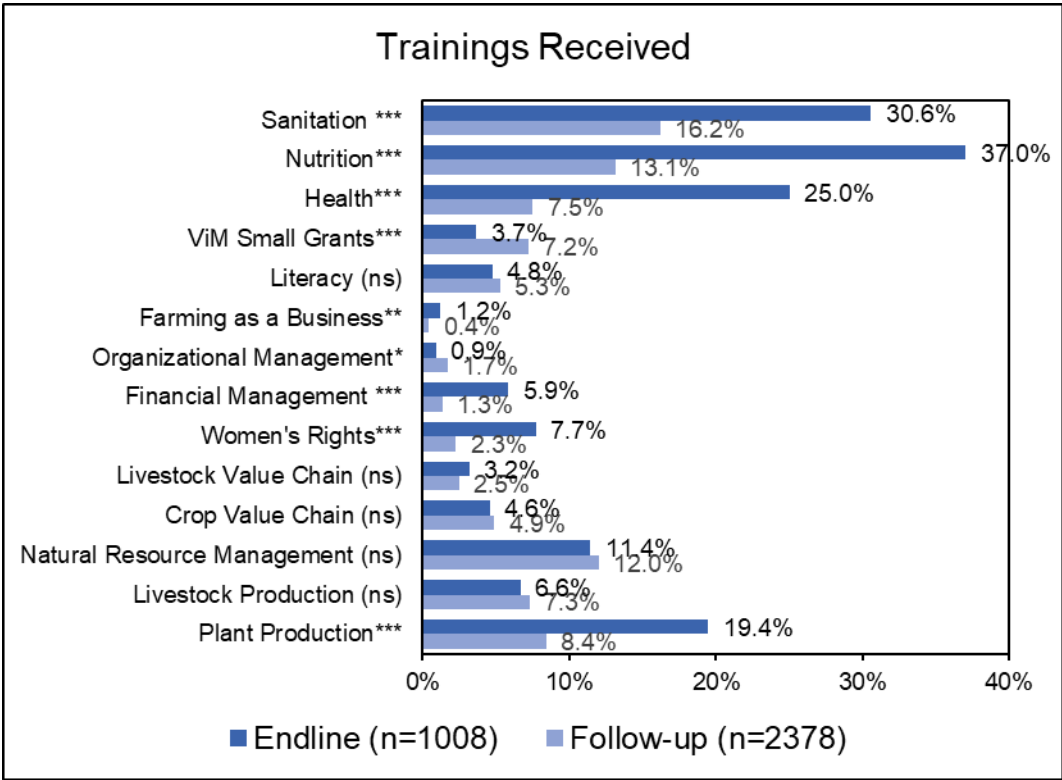


Figure 8: Farmers reporting having received trainings on specific subjects, endline and follow-up

Table 10 shows participation in ViM activities and receipt of categories of packages of trainings, inputs, and resources, from ViM and otherwise, as reported at endline and follow-up. Similarly,

Figure 8 shows the percentage of farmers having received trainings on specific subjects at endline and follow-up. The proportion of survey respondents reporting receiving trainings during ViM implementation declined in many instances between 2017 and 2021, suggesting that many respondents have forgotten whether they participated or have failed to attribute the trainings in which they participated to ViM (see column 4 from the left in Table 10 above). The proportion of households reporting having received the same trainings since 2018 dropped significantly for all trainings (see the column entitled “FU since 2018” in Table 10 above). Access to agricultural and other trainings is lower now in the community than during ViM programming. Other variables, though, show increases between endline and follow-up, including receiving equipment, crop inputs, and livestock inputs, suggesting that community members are continuing to use these materials and are sourcing them elsewhere now that ViM is no longer on the ground.

The picture is quite different with respect to receipt of inputs and equipment. Farmer reports indicate that receipt of crop and livestock inputs rose dramatically after 2018: well over half (as high as 76% in some cases) received livestock or crop inputs from other sources; a third received land. While 27% of farmers reported receiving non-ViM support after program exit, clearly the numbers receiving benefits from other institutions, government or non-governmental, is substantially higher.

For most of the inputs on which farmers reported, the market was the source cited by the large majority, but about a quarter of farmers received vaccines from a VVV in the agricultural campaign of 2021 when the follow up survey was conducted, a decline from endline, but still a significant proportion, while a third or more obtained vaccines from a governmental organization. It should be noted that some vaccines for specific highly contagious outbreaks are outside the scope of work of the village vaccinators and must be administered by the government, and some of these vaccines may be included in the percentage of government-administered vaccines mentioned above.

4.3 SO2: Increased Household Income

The strategies for improving household income included establishing savings and internal loan committees (SILCs) to support the creation of small businesses and providing training in marketing skills. Household economic well-being was assessed by measures of household dietary diversity, presence of household hunger, and through improved links to markets and increased sources of revenue.

4.3.1 Dietary Diversity and Food security

Household dietary diversity fell from 4.33 to 3.66 over the course of ViM; it fell slightly but not significantly (to 3.19) between endline and follow up (see Figure 9). Over that period, consumption of meat and poultry, fish, milk, and pulses fell, while consumption of eggs increased (but was reported by few households at either time point); frequency of reported vegetable consumption fell, while that of fruit rose (see Table 11).

Household hunger was assessed by administering the household hunger scale to respondents. Recall that baseline and follow up surveys were implemented in June and July, respectively, during the hungry season, while the endline survey was conducted in December, post-harvest. Thus, the endline survey asked about household hunger at the time of the survey (December) and retrospectively to the previous July, a measure that should be more comparable to the other two surveys but poses risk of recall bias. In fact, the recalled prevalence of household hunger was only 7%, compared with the contemporaneous report of 3%. The percent of households reporting

moderate or severe hunger fell from baseline to endline but increased at follow up. From baseline (before ViM) to follow up, however (three years after closure), the prevalence of moderate to severe hunger fell from 34% to 12%, a more meaningful measure of improved household well-being (see Figure 10).

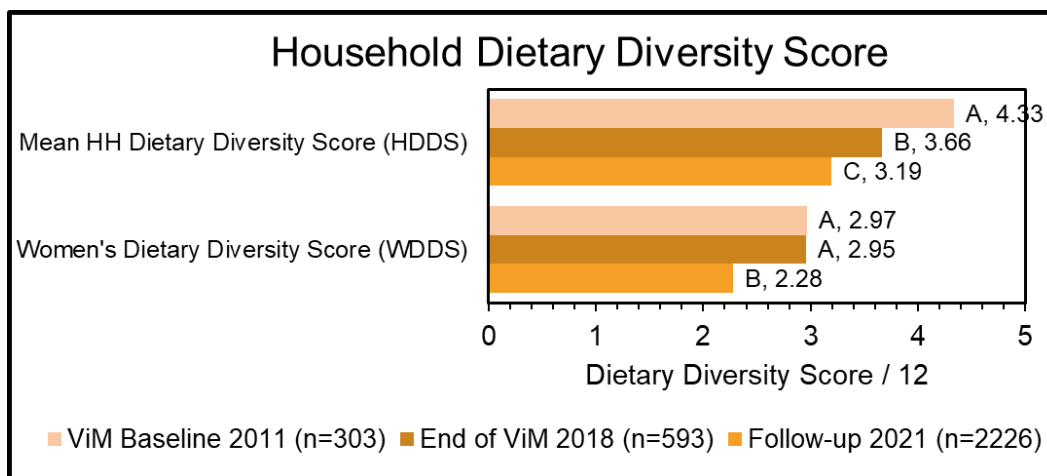


Figure 9: Dietary diversity scores for the household as a whole and for women

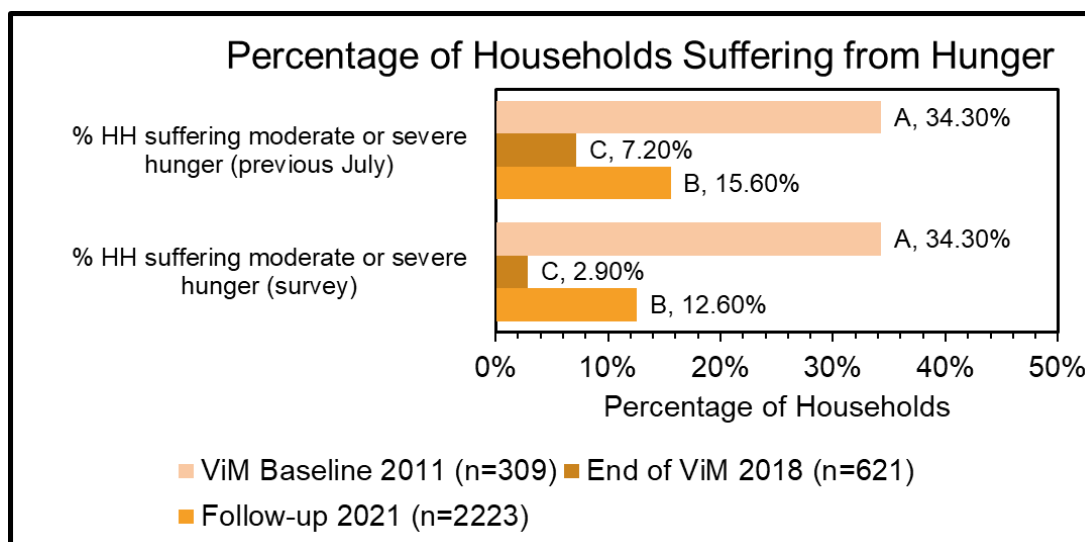


Figure 10: Prevalence of moderate or severe hunger at baseline, endline, and follow-up

Consumption of specific food groups						
Description	EL	FU	Diff (FU-EL)	Sig. (EL-FU)	N (EL)	N (FU)
Cereals	97.8%	98.0%	0.2%	Ns	593	2,233
Roots and Tubers	3.0%	1.8%	-1.2%	*	593	2,233
Vegetables	79.9%	70.6%	-9.3%	***	593	2,233
Fruits	9.4%	25.8%	16.4%	***	593	2,233
Meats and Poultry	7.6%	4.9%	-2.7%	**	593	2,233

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Eggs	0.2%	2.4%	2.2%	***	593	2,233
Fish	57.8%	27.3%	-30.5%	***	593	2,233
Pulses	28.7%	15.2%	-13.4%	***	593	2,233
Dairy	5.2%	1.9%	-3.3%	***	593	2,233
Oil/Fats	21.8%	18.0%	-3.8%	**	593	2,233
Sugar/Honey	35.2%	31.3%	-4.0%	*	593	2,233
Miscellaneous	19.2%	22.3%	3.0%	Ns	593	2,233

Table 11: Consumption of specific food groups making up the dietary diversity scores

4.3.2 Assets

We calculated total value of assets owned based on each respondent’s report of items owned, number owned, and estimated value. The information was collected separately and summed for a set of domestic items (such as beds and radios), transportation items (car or truck, moto, bicycle), and productive assets (agricultural equipment and machinery). The distributions of the resulting indices showed a few extreme, implausible outliers, and these outliers were eliminated by cutting values higher than 300% of the interquartile range above the 75th percentile or below 300% of the IQR below the 25th percentile and imputing a plausible value using the Winsorizing technique [30] using the method provided in the Stata software program [31, 32]. Figure 11 shows the three asset categories and the sum (total value of assets owned). On average, households increased the total value of assets owned significantly from EL to FU, and this increase appears to have been driven by an increase in ownership of domestic and transportation assets; the value of productive assets did not show a significant c by any of the measures.

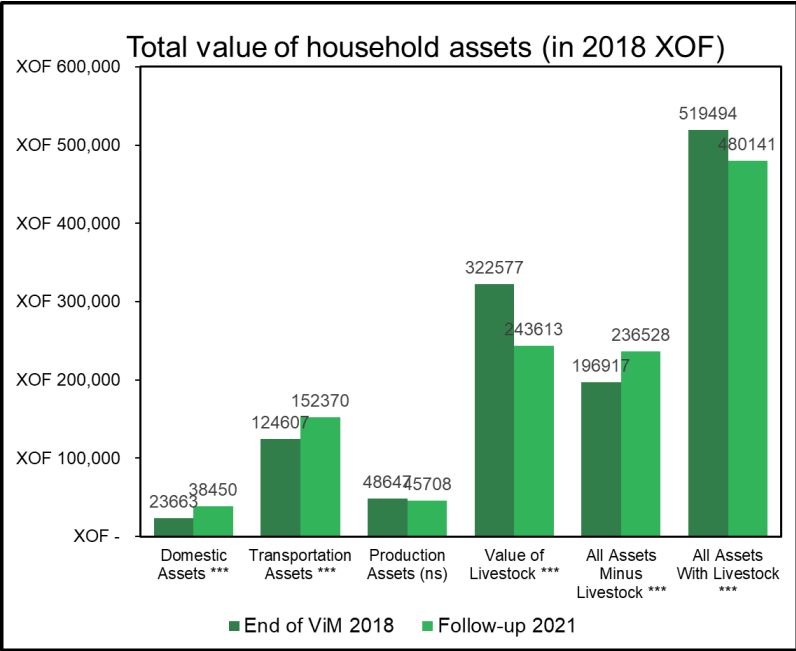


Figure 11: Total asset value in 2018 FCFA at endline and follow-up

Average number of cattle and poultry sold increased significantly from endline to follow-up (see Figure 12). This reported increase in sales is in alignment with the significant increase in farmers reporting that livestock sale was their main source of livelihood. Sale of livestock was also cited

by 36% of farmers as a coping strategy for dealing with economic and climate shocks (see Table 20), thus possibly resulting in fewer livestock owned. Because of this, an asset index including the value of livestock owned showed a decline in total assets at follow up.

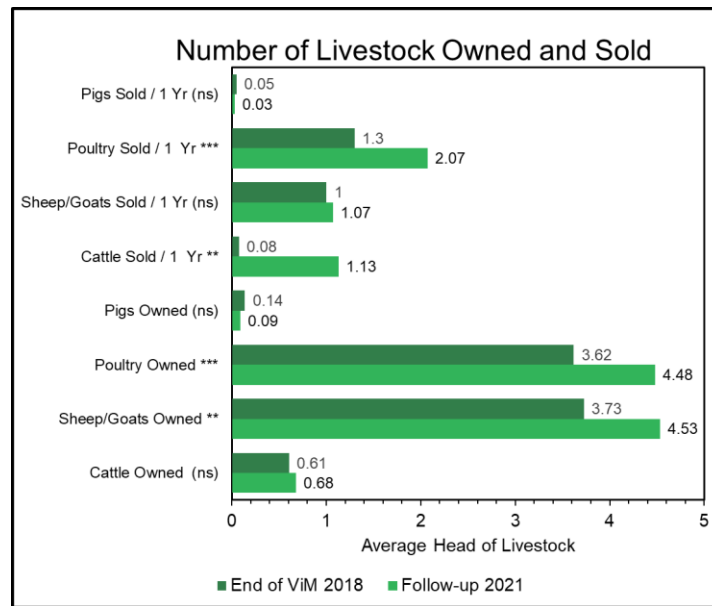


Figure 12: Number of livestock owned and sold at endline and follow-up

An ownership index was also calculated. We took the 13 domestic items included in the EL report and constructed a simple indicator summing the number of individual items owned (irrespective of the number of each), and the same for the 23 productive items. Using this indicator, Figure 12 **Error! Reference source not found.** also shows the number owned of each type of livestock, and it shows that number of sheep/goats and poultry rose significantly between endline and follow-up, with average number of sheep/goats rising from 3.56 to 4.53 per household and poultry rising from 3.60 to 4.42, respectively.

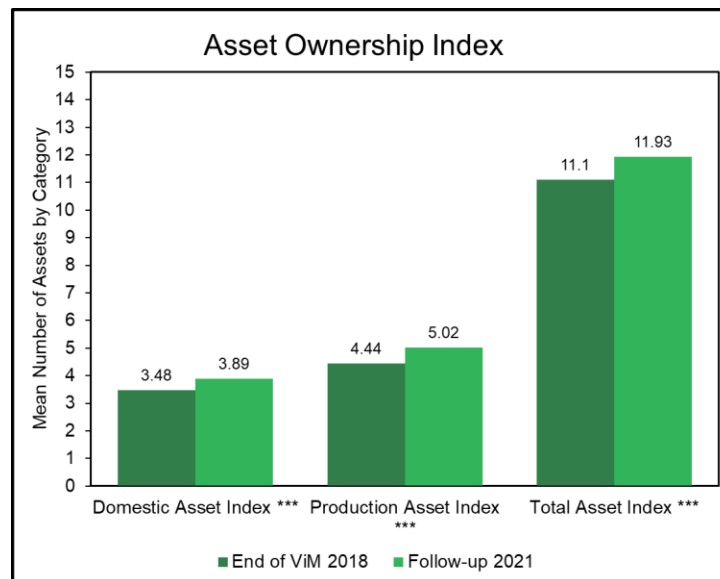


Figure 13: Domestic, production, and total asset indices

4.3.3 Income Sources and Livelihoods

Very few households reported having three or more sources of revenue at any time point: 1.00% at baseline, 3.50% at endline, and 2.35% at follow up. While these differences are statistically significant due to the large sample size, they are probably not meaningful in practical terms. More relevant is the decline in integration into crop value chain activities. This number rose during ViM from 49% to 57% but fell by the time of follow up to 33% of farmers producing crops, consistent with the declining numbers of farmers reporting crop sales. From EL to FU there was a significant increase in agricultural day labor and wage labor as primary sources of revenue, reported by 10% and 4% respectively at FU. The majority of farmers reported selling harvest or livestock as their primary revenue source at both time points, with reliance on livestock sales increasing significantly.

The table below shows results of regressions revealing what factors are related to participation in crop value chain activities. Clearly, membership in any producer association is associated with the probability of participating in value chain activities. This finding further underscores other findings suggesting that membership in producer organizations lead to tangible benefits for farmers, including access to inputs and markets. Owning an additional hectare of land also increases the probability, although the magnitude is smaller than producer association membership. Owning more domestic assets, planting more crops, and selling crops for money also are associated with a higher probability of value chain activities. Participating in a crop value chain training was only significant in regression 1, controlling for production of individual crops, as shown in Table 12 below.

Participation in value chain activities (crops)			
	(1)	(2)	(3)
VARIABLES	y1	y1	y1
Producer association	0.165*** (0.034)	0.182*** (0.033)	0.148*** (0.034)
Farmer age	-0.000 (0.001)	-0.001 (0.001)	0.000 (0.001)
Farmer is female	0.033 (0.040)	0.019 (0.039)	-0.004 (0.041)
Total land area (ha)	0.035*** (0.009)	0.037*** (0.010)	0.036*** (0.009)
Domestic assets index	0.017*** (0.007)	0.020*** (0.007)	0.015** (0.007)
Cowpea	-0.208*** (0.045)		
Sorghum	-0.088* (0.053)		
Rice	0.058 (0.063)		
Onions	0.231*** (0.052)		
Tomatoes	-0.006 (0.098)		
# of household members	-0.004	-0.001	-0.003

Participation in value chain activities (crops)			
VARIABLES	(1) y1	(2) y1	(3) y1
	(0.005)	(0.006)	(0.006)
Experienced terrorism	0.002 (0.047)	0.017 (0.049)	0.022 (0.048)
Value chain training (crops)	0.107** (0.045)	0.064 (0.050)	0.045 (0.051)
Received equipment		0.032 (0.028)	0.034 (0.026)
Number of crops		-0.037*** (0.012)	-0.048*** (0.011)
Sold crops for money			0.225*** (0.027)
Observations	2,215	2,215	2,215
Pseudo R-squared	0.0817	0.0536	0.0896
Actual Prob.	0.326	0.326	0.326
Predicted Prob.	0.317	0.319	0.313

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients represent marginal effects of independent variables on the outcome variable at the mean values of each variable.

Table 12: Regressions showing determinants of participation in value chain activities

4.3.4 ViM Sustainability Strategies

As noted above, at the time of follow up, there had been a decline in the number of farmers participating in producer groups, making use of financial services, or accessing up to date price information or receiving production-related training, suggesting barriers to the continuation of these activities after program closure.

The formation of neighborhood savings and loan groups (SILCs) was a key element in the ViM sustainability strategy, but the percent of women reporting membership in a SILC declined from 34% to 9% from EL to FU. While the data collected do not enable an empirical determination of whether village SILCs were still operational or had been dissolved at the time of follow-up, it is likely that at least some SILCs were no longer functional, based on the drop in the number of women reporting membership. As reported in Table 10, participation in SILC training activities fell to near zero (0.1%) in the years after 2018. One goal of the formation of SILCs was to encourage members to establish their own small businesses. The percent of farmers reporting small business as their main source of revenue fell from 27% to 20% from EL to FU; sale of crafts as a main source of revenue was unchanged at 13% (see Table 9). The lack of persistence of this intervention, which has demonstrated sustainability in other contexts, merits further investigation.

4.4 SO3: Reduced Chronic Malnutrition

4.4.1 Stunting and Underweight

The prevalence of stunting among children under five years old fell substantially during the program, from 38% at baseline to 20% at endline (see Figure 14 and Table 13), then increased to 27% at follow up, still well under the baseline level. The increase in stunting was significant among

both children under age two and children two to five, but the rate of increase was almost double in the younger group, going from 10% at endline to 20% at follow up. In the two to five-year age group, prevalence of stunting increased from 20% to 30%. Notably, the prevalence of underweight (weight-for-age < -2SD) decreased from 22% to 16% from baseline to endline, and that improvement was maintained at follow up in both age groups.

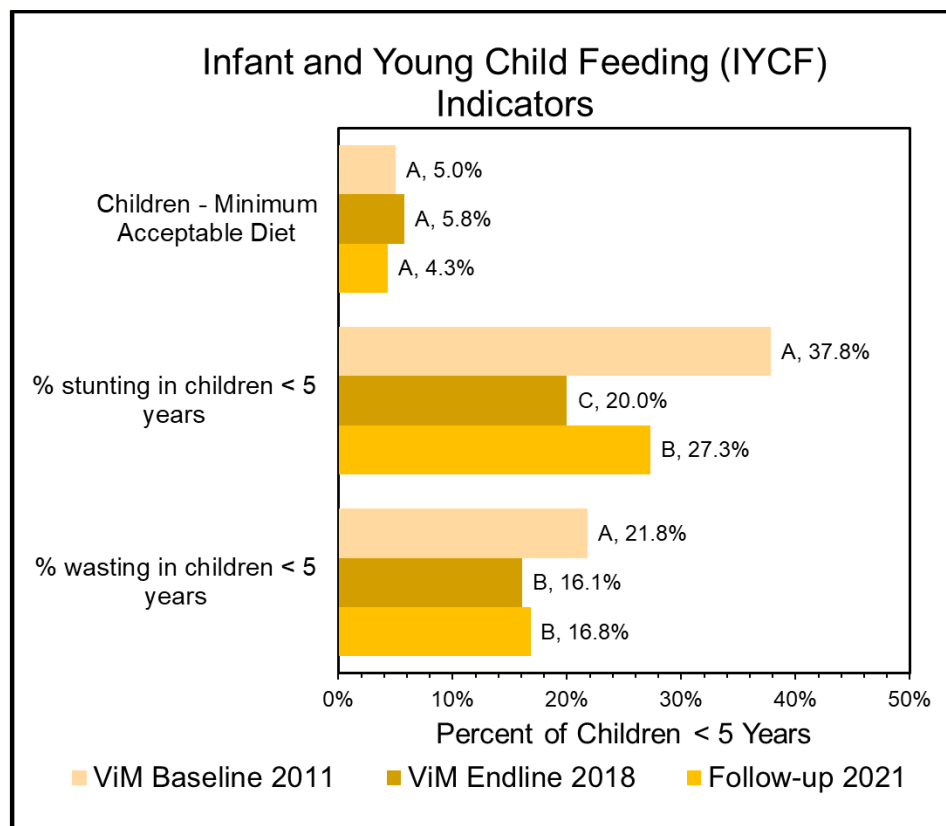


Figure 14: Child stunting and underweight at baseline, endline, and follow-up

Child stunting and underweight broken down by age						
Description	EL	FU	Diff (FU-EL)	Sig.	N (EL)	N (FU)
Percentage of stunted children under five years of age < 2 years	10.4%	19.9%	9.6%	***	251	346
Percentage of stunted children under five years of age > 2 years	25.1%	30.5%	5.4%	**	478	843
Percentage of underweight children under five years of age < 2 years	15.5%	18.9%	3.3%	ns	251	355
Percentage of underweight children under five years of age > 2 years	16.4%	16.0%	-0.3%	ns	483	842

Table 13: Child stunting and underweight for children 5 years of age and under, by age

There was no difference in the prevalence of stunting between boys and girls at follow up, but the prevalence of underweight was significantly higher among boys than girls: 19% for boys as compared with 13% for girls.

Child stunting and underweight at follow-up						
Description	Male	Female	Diff	Sig. (M-F)	N (M)	N (F)
			(M-F)			
Prevalence of stunted children under five years of age	28.9%	26.6%	2.3%	ns	491	485
Prevalence of underweight children under five years of age	19.4%	13.2%	6.2%	***	496	486

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 14: Child stunting and underweight by gender at follow-up

4.4.2 Child Diet

For children under six months, exclusive breastfeeding is recommended and was promoted in the program. Exclusive breastfeeding could not be evaluated for infants under six months at FU as information on the consumption of liquids was not available due to an error in the tablet-based survey which led to the omission of certain questions on liquid consumption. However, the percent of children fed no solid, semisolid, or soft foods in the past 24 hours was unchanged at ~89% from endline to follow up. Minimum acceptable diet (MAD) is assessed for children six months to two years of age based on achieving minimum diet diversity and minimum meal frequency. As minimum meal frequency depends on frequency of milk feeds for non-breastfed children, MAD could not be assessed for non-breastfed children. However, 98% of all children 6 – 23 months were breastfed in the previous 24 hours. At endline, 6.3% of breast-fed children aged 6-23 months had achieved MAD, and there was a non-significant decline to 4.4% at follow-up. No significant changes were observed for MAD when separated by age group (6 – 8 months, 9 – 23 months). The component of MAD driving its decline was minimum diet diversity, which was reached by 20% of children under two at endline and by 8.4% at follow up. Among children between 6 and 8 months old, only about 2% reached minimum diet diversity at either time point, suggesting introduction of appropriate complementary food is inadequate. About a third of children 6 – 23 months reached minimum meal frequency at both time points; slightly lower for children 6 – 8 months.

Child diet indicators at endline and follow-up						
Description	EL	FU	Diff (FU- EL)	Sig. (EL- FU)	N (EL)	N (FU)
Percentage of children achieving Minimum Acceptable Diet (6-23 months) §	6.3%	4.4%	-2.0%	ns	189	273
Percentage of children achieving Minimum Acceptable Diet (6-8 months) §	0.0%	0.0%	0.0%	ns	33	53
Percentage of children achieving Minimum Acceptable Diet (9-23 months) §	7.7%	5.5%	-2.2%	ns	156	220
Percentage of children achieving Minimum Dietary Diversity (6-23 months) §	20.1%	8.4%	-11.7%	ns	189	273
Percentage of children achieving Minimum Dietary Diversity (6-8 months) §	3.0%	1.9%	-1.1%	ns	33	53

Child diet indicators at endline and follow-up						
Description	EL	FU	Diff (FU-EL)	Sig. (EL-FU)	N (EL)	N (FU)
Percentage of children achieving Minimum Dietary Diversity (9-23 months) §	23.7%	10.0%	-13.7%	ns	156	220
Percentage of children achieving Minimum Meal Frequency (6-23 months) §	29.1%	35.5%	6.4%	ns	189	273
Percentage of children achieving Minimum Meal Frequency (6-8 months) §	15.2%	26.4%	11.3%	ns	33	53
Percentage of children achieving Minimum Meal Frequency (9-23 months) §	32.1%	37.7%	5.7%	ns	156	220
Child Dietary Diversity Score (breast-fed children only) §	3.43	2.78	-0.65	ns	189	273
CDDS Food Groups †						
Grains, roots, and tubers	78.4%	65.5%	-12.9%	***	208	278
Legumes and nuts	15.9%	2.5%	-13.3%	***	208	278
Dairy products	56.3%	8.6%	-47.6%	***	208	278
Flesh foods	29.3%	65.5%	36.1%	***	208	278
Eggs	1.4%	0.0%	-1.4%	**	208	278
Vitamin-A rich fruits and vegetables	39.4%	29.1%	-10.3%	**	208	278
Other fruits and vegetables	9.1%	6.5%	-2.7%	ns	208	278
Percentage of breastfed children (6-23 months)	90.9%	98.6%	7.7%	ns	208	277

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 15: Child diet indicators at ViM endline and follow-up in 2021

4.4.3 Child Care Practices

ViM promoted, through care groups, mother-leaders, and community health agents, a set of positive childcare and feeding practices. One promoted practice was to put a newborn to the breast within one hour of birth. This practice increased during ViM from 54% to 84% and saw a significant increase up to 88% at follow up (see Figure 15).

The percent of children 12 – 23 months of age who were fully immunized also showed a sustained increase, from 54% to 84% during ViM, and remained high at 88% at follow up. The percent of children with growth monitoring in the past six months fell from 70% to 60% after ViM closure, still higher than the 45% at baseline. Other indicators were less successfully sustained. The percent of children 6 – 23 months old receiving vitamin A supplementation fell from 71% to 50% from baseline to follow up, having increased from 65% at baseline. This decrease could be due to delays in government-sponsored vitamin A supplementation campaigns, as vitamin A distribution is normally led by the Burkinabè Ministry of Health and Public Hygiene (*Ministère de la santé et de l'hygiène publique*, MSHP). The significant increase in women knowing the critical moments for handwashing, from 2% to 45% during the program, declined, though at follow up, that number was still 23%, well above baseline.

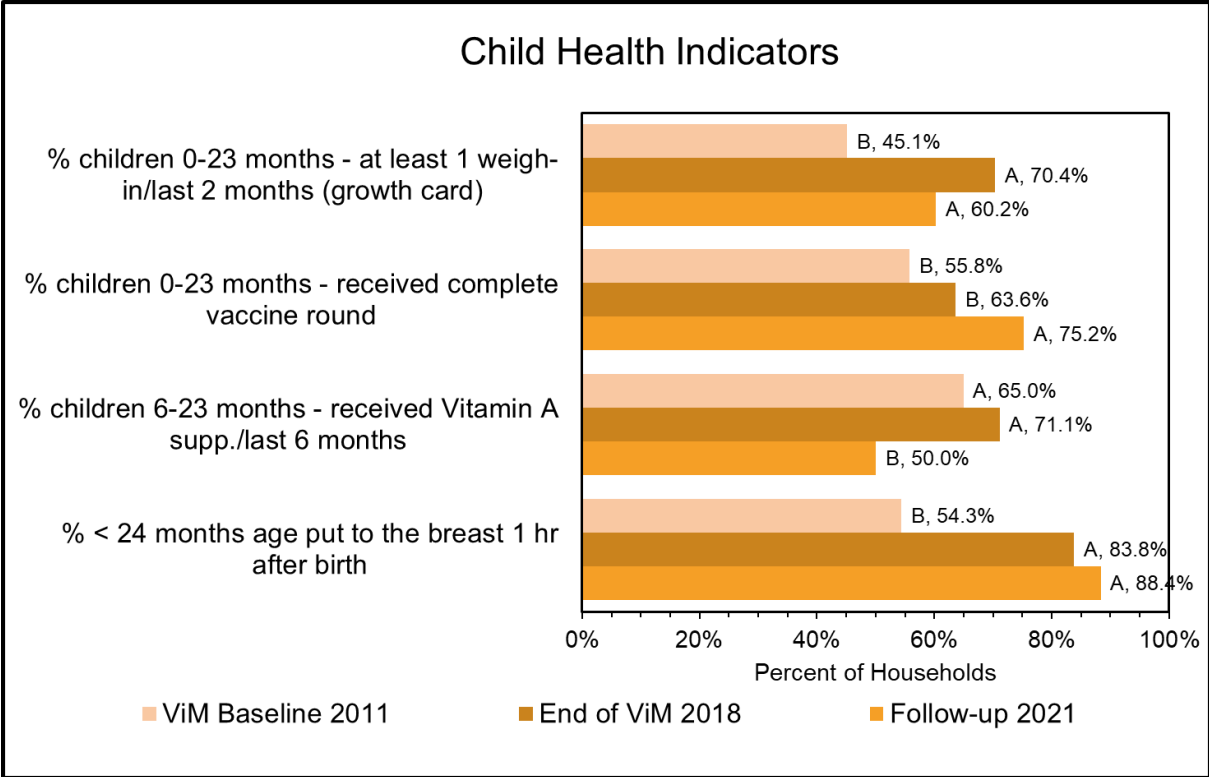


Figure 15: Child health indicators at baseline, endline, and follow-up

4.4.4 Women’s Diet

In collecting dietary diversity data, enumerators asked whether a respondent had eaten nothing at all in the previous day. These were considered to have a diet diversity score of zero. Other women reporting zero consumption were excluded from our calculations; the endline analysis originally included them. The conclusion that dietary diversity fell from endline to follow up is consistently supported whether the scores of zero are excluded or included, and the size of the difference is consistent. The only food groups showing an increase in consumption were eggs (consumed by fewer than one percent of women at either time point, however) and dark green leafy vegetables, consumed by 60% at endline and 71% at follow up; most other foods showed a decline in consumption, including meat, dairy products, pulses, and even the grain/root/tuber category. This pattern reflects that of the household’s diet diversity score. The increase in vitamin A-rich dark green leafy vegetables is a promising result and could have been observed due to other NGO and development programs in the area working on nutrition-sensitive agriculture or safe storage for produce.

Women’s dietary diversity indicators at endline and follow-up						
Description	EL	FU	Diff (FU-EL)	Sig. (EL-FU)	N (EL)	N (FU)
Women's Dietary Diversity Score	2.97	2.28	-0.69	***	861	2114
Food Groups						
Grains, roots, and tubers	77.5%	63.8%	-13.7%	***	861	2114
Legumes and nuts	49.2%	17.0%	-32.3%	***	861	2114

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Dairy products (milk, yogurt, cheese)	8.2%	2.8%	-5.5%	***	861	2114
Organ meat	1.9%	0.3%	-1.5%	***	861	2114
Eggs	0.5%	2.3%	1.9%	***	861	2114
Flesh foods and other misc. small animal protein	60.4%	33.2%	-27.2%	***	861	2114
Vitamin A-rich dark green leafy vegetables	60.6%	71.2%	10.6%	***	861	2114
Other vitamin A rich vegetables and fruits	19.7%	20.5%	0.8%	ns	861	2114
Other fruits and vegetables	18.9%	16.4%	-2.5%	*	861	2114

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 16: Women's dietary diversity indicators at endline and follow-up

4.4.5 Health Care Services

All women with a pregnancy in the last 24 months reported having at least one antenatal care visit (see Figure 16). The average number of antenatal care visits was about four at endline and follow up. The target of at least four antenatal care visits was reached by 81% of women at the end of the ViM program, up from 51% at baseline. That number fell to 69% by follow up, still higher than at baseline. This reduced access/use of health care is reflected in a decline in the percent who received iron/folate supplements in the past week (56% to 41%) or in the past year (95% to 89%), though coverage is still high (not measured at baseline). The percent of women with children 0 – 23 months who received a vitamin A supplement immediately post-partum rose from 47% to 78% during ViM but declined to 58% at follow up. The percent of children over age one who were fully vaccinated, however, increased only slightly from BL to EL, but increased significantly, from 64% to 75% from EL to FU. The percent of women who had a growth monitoring visit in the past two months, which doubled from 45% to 70% during the program, declined to 60% by FU, still well over baseline, and the percent of women receiving a postnatal check within two days of birth decreased from 72% at endline to 60% at follow up, a marginally ($p < 0.1$) significant change. Results shown in Figure 16. Some of these indicators may have fallen between endline and follow-up due to restrictions on gathering and lower access to routine health services during the Covid-19 pandemic.

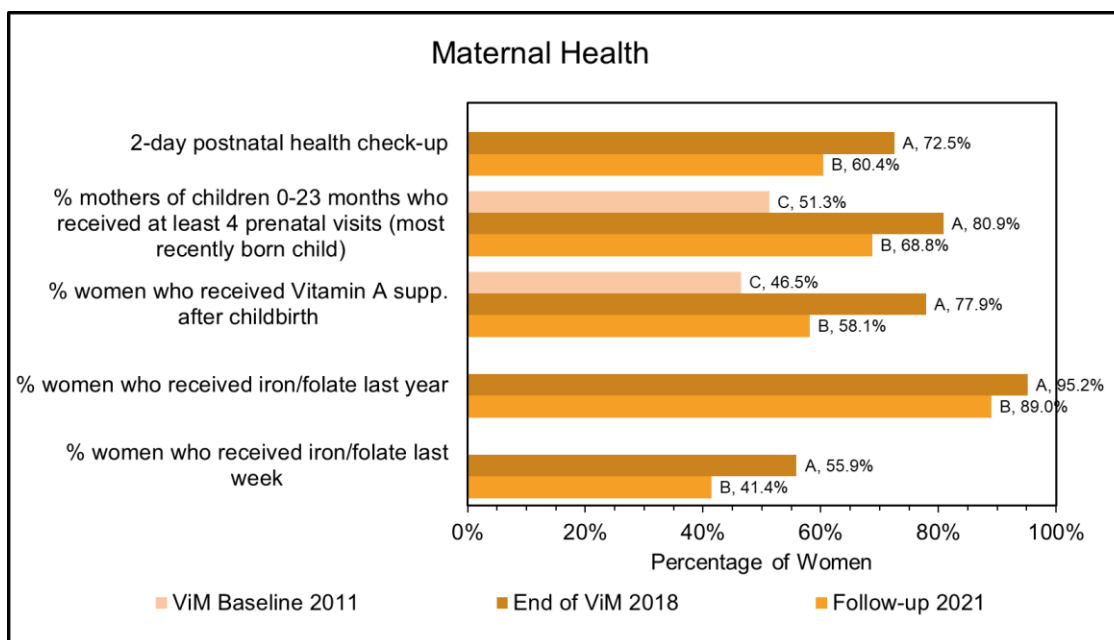


Figure 16: Women’s healthcare access indicators at endline and follow-up

At endline, almost all women (89%) who received antenatal care (ANC) received it from a nurse/midwife, and this did not change at follow up. A much smaller percentage received antenatal care from any other provider: 21% saw an auxiliary birth attendant; fewer than 5% saw a doctor; and use of traditional birth attendants (TBAs), community-based health agents (CBHAs), and mother leader animators (MLAs) was negligible. Almost no one reported having an unattended birth, and the majority of attended births were attended by a nurse or ‘sage femme’, and the distribution of birth attendants reflected that of providers of antenatal care.

Women’s health provisioning indicators						
Description	EL	FU	Diff (FU-EL)	Sig. (EL-FU)	N (EL)	N (FU)
Percentage of women who reported visiting this person for ANC visits - Doctor	5.9%	1.9%	-4.1%	ns	271	331
Percentage of women who reported visiting this person for ANC visits - Nurse/Mid-wife	89.3%	84.2%	-5.1%	ns	271	331
Percentage of women who reported having this person attend their birth - Doctor	5.5%	0.6%	-4.9%	ns	272	353
Percentage of women who reported having this person attend their birth - Nurse/ mid-wife	88.2%	85.6%	-2.7%	ns	272	353
Percentage of women who reported having this person attend their birth - Nobody	0.0%	1.1%	0.8%	ns	272	353
Mean number of ANC sessions attended	4.19	3.88	-0.31	ns	271	333

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 17: Women’s health provider indicators at endline and follow-up

4.4.6 Water, Sanitation, and Hygiene

Sanitation and hygiene practices were a focus of the work of MLAs and CBHAs under ViM. The percent of women with children under age two who were able to identify the critical moments for handwashing increased from 2% to 45% during ViM but fell to 23% (still considerably higher than baseline) at follow up (see Figure 17). The presence of a handwashing station also declined after ViM closure: among both households with children under age two and all households, presence of a handwashing station with water and soap rose from 2 – 3% at baseline to over 20% during ViM and fell to between 6% and 7% by follow up. (The definition of handwashing station required it to be in a fixed location; it is possible that a movable bucket or other facility with soap may have been present and not assessed.) Improved sanitation facilities, however, increased substantially at follow up: at the end of ViM, 10% of households had an improved sanitation facility, up from only 1% at baseline; this number increased significantly to 49% at follow up, possibly reflecting the presence of a sanitation intervention in the region.

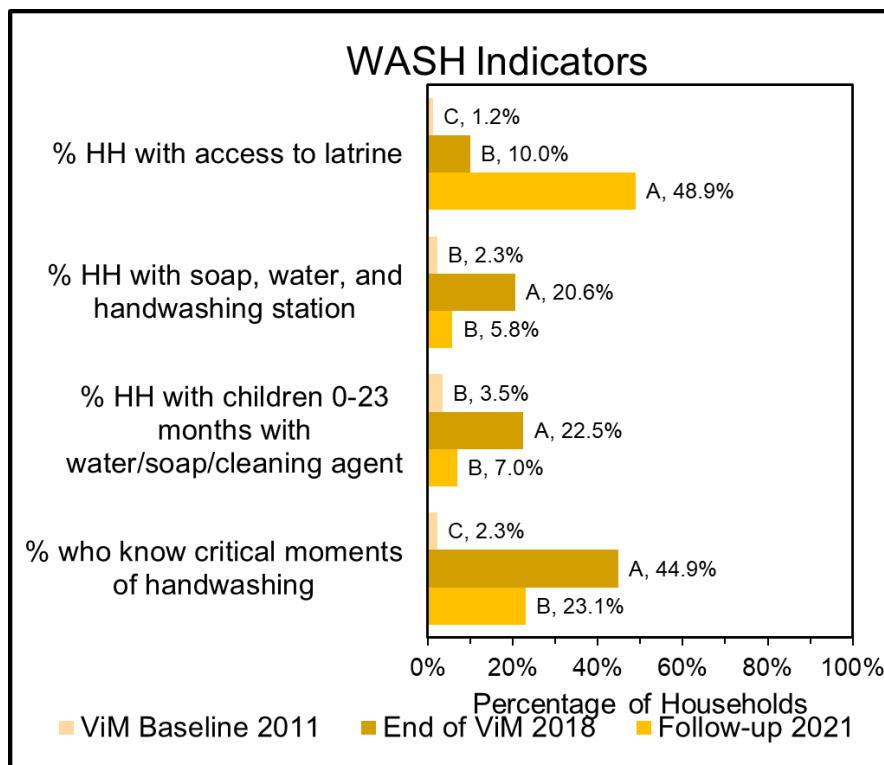


Figure 17: Household water, sanitation, and hygiene (WASH) indicators

4.4.7 ViM Sustainability Strategies

4.4.7.1 Community Health Workers

ViM trained mother leaders and community health agents and formed local groups to support health practices as well as other aspects of the program. At endline, 76% of women said that they were aware of mother leader (MLA) groups; this declined to 61% at follow up. Among those who knew an MLA group, about 18% of women at follow up said they received support from an MLA.

4.4.7.2 Provision of Supplementary Food Rations

Throughout ViM, rations of specialized nutritious food were provided monthly to 21,555 pregnant and lactating women and to 27,801 children 6 – 24 months of age. Provision of these rations ended in September 2016. Provision of any free resource is not sustainable once the resource is withdrawn, but the rations were intended not only to improve the nutritional status of the recipients at the time, but also to provide a vehicle for giving caregivers training on appropriate feeding practices (including preparation of porridge as a complementary food) and on sanitation and hygiene practices. The endline report demonstrated a positive impact of rations combined with ViM’s SBCC interventions on the rate of stunting among those who received rations. Based on preliminary analysis of child and adult outcomes (stunting and underweight, diet diversity and adequacy) and access to health services (ANC visits, receipt of nutrient supplements and vaccinations), report of having received rations during ViM did not appear to be associated with improvements in these indicators.

4.5 Cross-cutting Objective: Gender

4.5.1 Empowerment

Women’s empowerment was promoted through a range of ViM activities and was primarily assessed using two variables: the number of women who reported participating in household decisions regarding her own or her children’s health care or in the use of money she had earned, and the number of women agreeing that there are occasions when it is acceptable for a man to hit his wife.

The percent of women reporting participating with their husbands in making decisions related to running their households rose from 71% to 80% during ViM but had fallen to 61% (lower than baseline) by the time of follow up (see Figure 18). The percent of women saying it may be justifiable for a man to hit his wife fell from 94% at baseline to 52% at endline; this number rose slightly (but significantly) to 57% at follow up, still considerably lower than at baseline. To understand the determinants of success of the ViM program in improving gender equality at the household and community levels, future research should explore what specific activities targeted these areas of women’s empowerment and to what extent they were promoted at the community level.

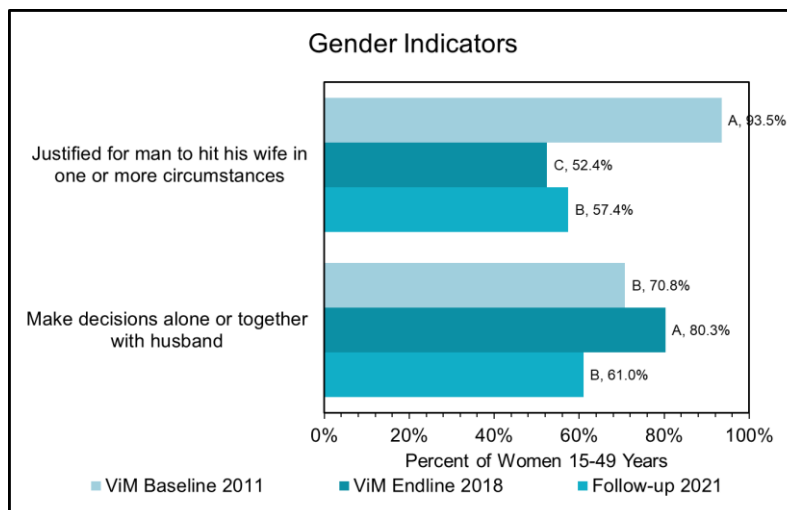


Figure 18: Women's gender empowerment indicators

4.5.2 ViM Sustainability Strategies

4.5.2.1 Participation in Group Activities

There was a decline in women's reported participation in most of the groups established during ViM. The percentage of women reporting having ever participated in an agricultural group fell from 52% at endline to 14% at follow-up; in economic groups from 21% to 3%; in empowerment groups from 16% to just 1%, and gender training from 24% to 2% suggesting a failure of recall. Thirty-four percent of women reported having participated in village savings and loan groups (a key element of economic empowerment) at endline, but the number currently participating fell to 9% at follow up. In some groups, reported participation was low at both endline and follow up. For example, women reporting having participated in a literacy group fell from 5% to 3%, a marginally significant decline.

Note that the column "FU – recall" in Table 18 shows the percent of respondents who declared having ever been part of the respective training or group listed. The column entitled "FU – received support ViM" shows the percentage who reported that their group received support from ViM during implementation. Finally, the column entitled "FU – group functions today" shows the percentage of respondents stating that the group was still functional as of June 2021. Significant differences are shown for the difference between endline and each of the follow-up columns (see columns labeled Dif. 1, Dif. 2, and Dif. 3, respectively). All significant changes represent decreases between endline and follow-up. The results show that if a respondent reported having ever been part of a group, at follow-up it is likely that the group received support during ViM and also that the group is still functional today. The key takeaway is that there was a marked decline in participation in these groups between endline in 2017 and follow up in 2021.

Women and household participation in groups and receipt of rations										
Variable Type		EL	FU – recall	Dif. 1	FU – received support ViM	Dif. 2	FU – group functions today	Dif. 3	N-EL	N-FU
Women	Agricultural Group	51.8%	13.6%	***	11.6%	***	10.1%	***	220	2112
	Women's economic group	20.9%	2.9%	***	2.4%	***	2.2%	***	220	2112
	Women's empowerment group	16.4%	1.0%	***	1.0%	***	0.9%	***	220	2112
	Women's literacy group	5.0%	2.8%	*	2.3%	**	1.3%	***	220	2112
	Women's religious group	2.7%	2.6%	ns	1.7%	ns	2.6%	ns	220	2112
	Village savings and loans group	33.6%	8.6%	***	6.0%	***	6.3%	***	220	2112
	Care/health group	n/a	6.5%	n/a	6.6%	n/a	4.5%	n/a	n/a	2112
	Other	4.1%	n/a	n/a	n/a	n/a	n/a	n/a	220	n/a

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Household	Rations 12-18	60.6%	37.1%	***	n/a	n/a	n/a	n/a	622	2242
	Rations after 18	n/a	5.3%	n/a	n/a	n/a	n/a	n/a	n/a	2242
	Rations Child	56.0%	33.9%	***	n/a	n/a	n/a	n/a	622	2242
	Rations PLW	43.1%	20.2%	***	n/a	n/a	n/a	n/a	622	2242
	Rations HH	20.9%	4.9%		n/a		n/a		622	2242

Table 18: Women and household participation at endline and follow-up

4.5.2.2 Training

In all the areas in which ViM provided training, there was a similar decline in women reporting receiving such training at follow up compared with endline. Women’s training, child training, and WASH training were received by over 50% of women at endline; however, by follow-up, only 10% reported having received these trainings. Agriculture training was received by 35% of women at endline and 20% at follow up; livestock training declined from 12% to 6% over that period. These are women’s reports of receiving training; application of the practices learned is reported under SO1 and SO3.

4.6 Cross-cutting Objective: Environment

Adoption of a minimum of three environmentally sustainable technologies was high (86% of farmers) at baseline and remained high at the end of ViM but declined to 69% of farmers by follow up (Table 19). The percent of farmers using at least two environmental mitigation principles in their income generating activities rose from 13% to 69% during ViM and declined to 38% at follow up.

Environmental Indicators (Crosscutting)										
Description	BL	EL	FU	Diff. EL-BL	Sig. EL-BL	Diff. FU-EL	Sig. FU-EL	N-BL	N-EL	N-FU
OC 36 - % beneficiaries adopting at least 3 environmentally sustainable technologies	85.52%	87.49%	69.46%	1.97%	ns	-18.03%	***	594	975	2364
OC 37 - % rural farmers reporting at least 2 environmental mitigation principals in diversified IGAs	13.32%	68.50%	37.68%	55.18%	***	-30.82%	***	593	727	2346
OC 38 - % farmers demonstrating knowledge of two sound pest management practices	59.70%	51.68%	n/a	-8.02%	***	n/a	n/a	593	985	n/a

Significance thresholds: ns = not significant; * = 0.10; ** = 0.05; *** = 0.01

Table 19: Environmental indicators at baseline, endline, and follow-up

4.7 Shocks, Stresses, and Resilience

At follow up, exposure to various shocks and stresses was assessed by asking the respondent whether they or anyone in the household had experienced each of a series of shocks. Figure 19 illustrates reported exposures to individual shocks.

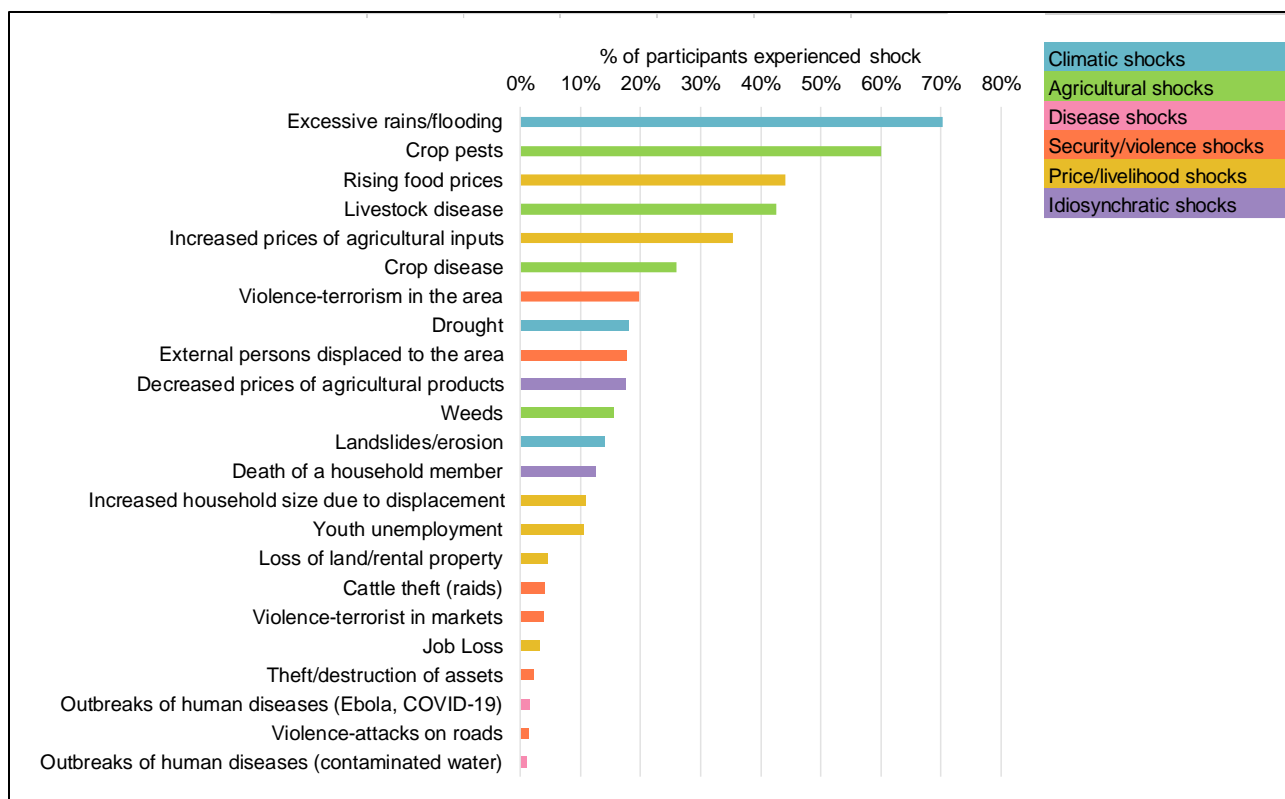


Figure 19: Percentage of household reporting experience of shocks by individual shock type

Figure 19 shows the percent reporting exposure to each reported shock separately. The most reported individual shocks were rain/flood (70%), crop pests (60%), crop diseases (26%), and livestock disease (43%), and rising prices of food (44%) and of agricultural inputs (35%).

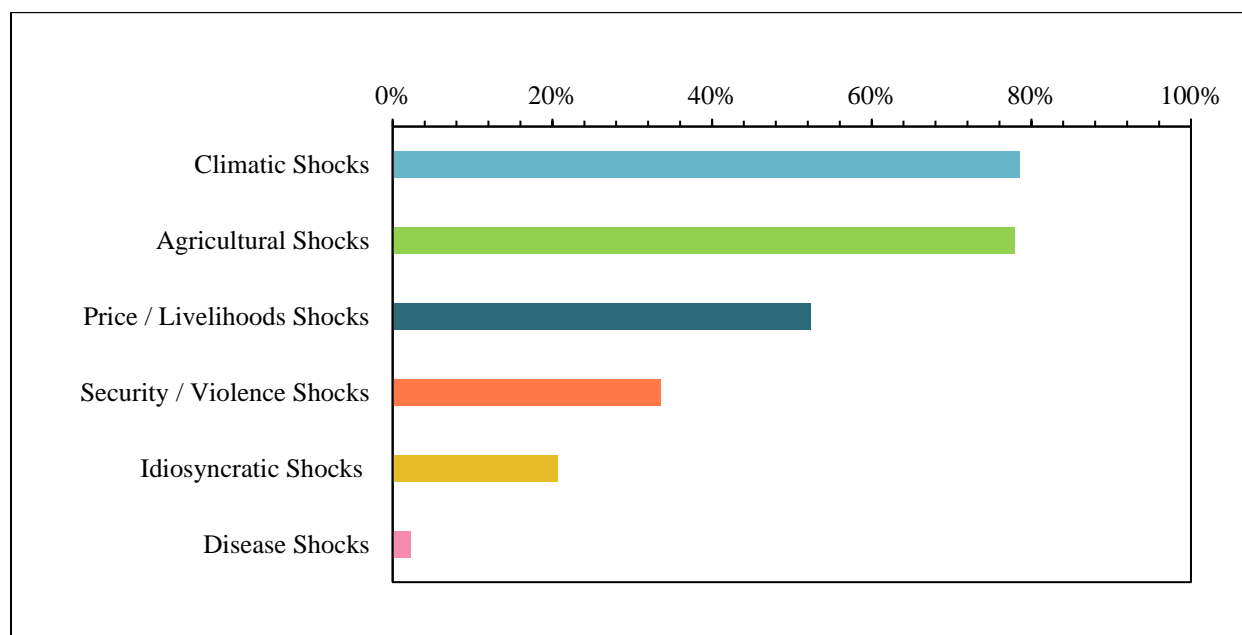


Figure 20: Percentage of households reporting experience of shocks aggregated by shock type

As many of the shocks were similar, the shocks were then grouped into categories: 1) climatic shocks (e.g., drought, flooding,), 2) agricultural shocks (e.g., pests, plant/animal diseases,), 3) security/violence shocks (e.g., terrorism in the community, market, or on the roads, theft, etc.), 4) shocks related to loss of livelihood or to price shocks (increase in food prices, loss of work), 5) human diseases and 6) idiosyncratic shocks (e.g., death of a household member) (Figure 20). Households were reported to experience this shock type if they experienced at least one of the shocks included in this category (see Figure 19). Close to 80% of households reported exposure to climatic and agricultural shocks, just over half reported economic shocks, and 34% reported exposure to conflict and insecurity shocks, such as terrorism. Terrorism in the community was cited by 20%, an influx of displaced persons in the community by 18% and in the household by 11%, and drought by 18%. Others were less commonly cited or were idiosyncratic to the household. These figures reflect reports of shocks experienced by the household, not expectations or fears about them. Fear of violence was cited in the qualitative investigation as a barrier to meeting in groups or traveling on the roads.

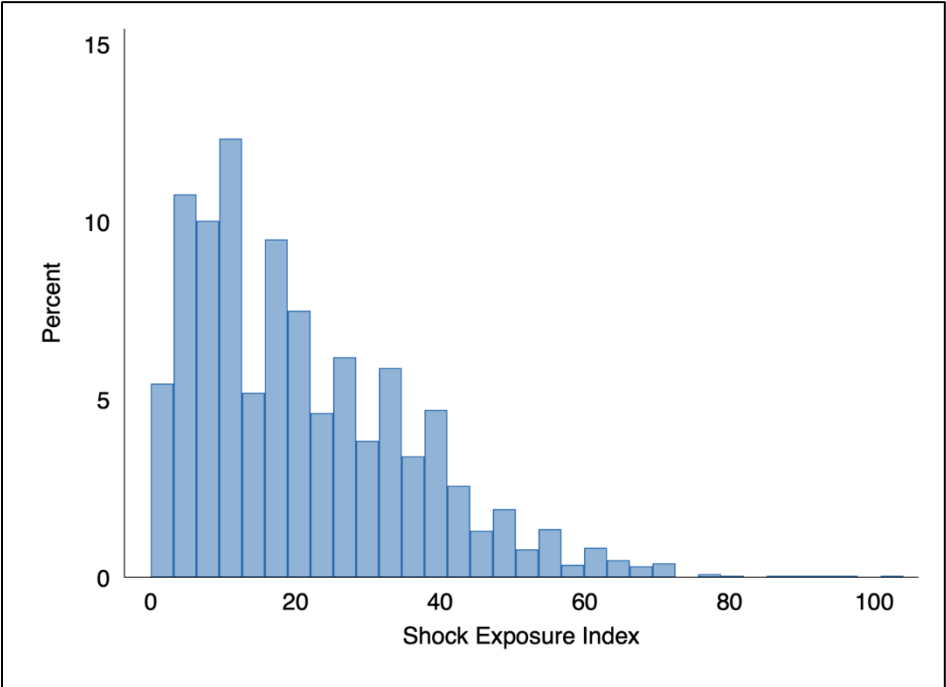


Figure 21: Distribution of shock exposure index scores

To explore the impact of shocks on the population since the conclusion of ViM in 2018, we followed guidance from TANGO’s household shock exposure and resilience indices (TANGO International, 2018). We used the shock exposure index to assess the overall degree of shock exposure per household by measuring the incidents of shocks experienced in the last 12 months and the perceived severity of each shock ¹. The index ranges from 0-184, where 0 represents no

¹ The shock exposure index assesses the overall degree of shock exposure per household by measuring the number of shocks experienced in the last 12 months and the perceived severity of each shock (TANGO International, 2018). First, we identify incidents of shock exposure by asking participants about a list of 23 shocks developed through guidance from resilience literature and modified to the context of Kaya based on formative qualitative research that we conducted in 2020. We identified incidents of shock exposure by asking participants about a list of 23 shocks developed through guidance from resilience literature and

shocks experienced and no perceived severity and 184 means that all shocks were experienced, and the impact was the most severe. The average household score was 21.09 with a standard deviation of 15.49. The highest score was 104. Results shown in Figure 21.

4.7.1 Ability to Recover

Respondents were asked their perception of their ability to recover from exposure to any of these shocks. Two questions addressed this issue: did their ability to meet food needs return to pre-shock levels, and did they believe they would be able to meet their food needs in the coming year (see Figure 22). Most respondents (62%) of households reporting exposure to shocks said their ability to meet food needs had returned to pre-shock levels, and another 20% said this ability was better than before the shock. Only 15% said their ability to obtain sufficient food was worse than before the shock, but this figure was 26% for households with a higher level of shock exposure. Most households reported that they believed their ability to meet their food needs would be as good (48%) or better (44%) in the coming year than currently. Only 5% believed their ability to meet their food needs in the coming year would be worse than at present.

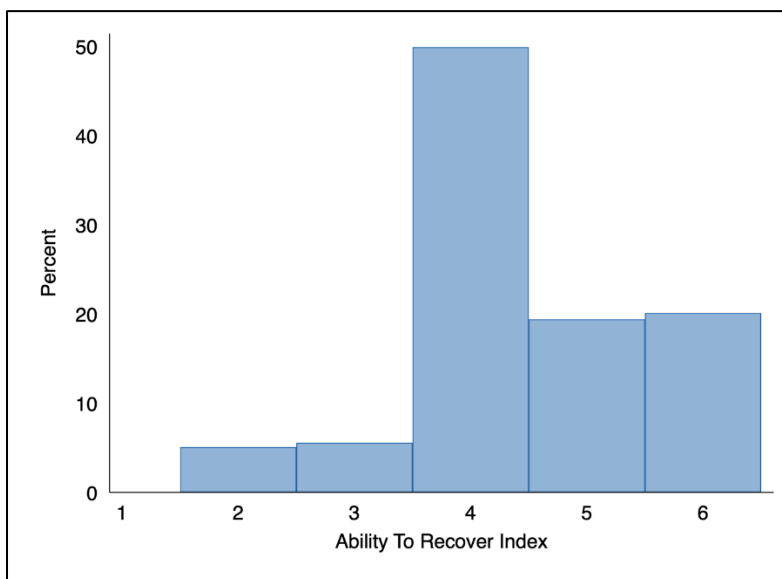


Figure 22: Distribution of ability to recover index

4.7.2 Coping Strategies

Households dealt with these shocks in a variety of ways, with most having to do with economizing (69%) or reducing non-essential household expenses (51%) or reducing food consumption (34%).

modified to the context of Kaya based on formative qualitative research that we conducted in 2020 (see Figures 3 and 4). Perceived severity is measured using two variables: impact on income security and impact on food security. If a shock was experienced, participants are asked “how severe was the impact of this shock on your income” and “how severe was the impact on household food consumption?”. The responses follow a four-point scale, where one is “no impact” and four is “worst ever”. Responses to these two questions are combined into one variable that has a minimum value of two and a maximum value of eight. The shock exposure index is then measured by finding the weighted average of the incidence of experience of each shock (one if experienced and zero if not experienced) by the perceived severity variable. The index ranges from 0 to 184, 8*total number of shocks (23). A score of 0 represents no incidents or severity of shock and 184 means all shocks were experienced to the worst perceived severity.

Government emergency aid was cited by 11% for cash and another 11% for food aid. While 36% reported selling livestock as a coping strategy (and the percent of farmers selling livestock rose from EL to FU), none reported selling agricultural equipment or productive or household goods. Remittances were cited by 19%; various kinds of loans by 6% - 20%. Less common were taking children out of school or sending them to work or migrating. (See Table 22.)

Coping strategies reported by households at follow-up	
Coping Strategy	%
Used own savings	69.0%
Reduced non-essential HH expenses	51.0%
Sold livestock	36.0%
Engaged in spiritual efforts (e.g., prayed, sacrifices, etc.)	36.0%
Reduced food consumption (quantity/meal; # of meals/day)	34.0%
Took out a loan (no interest) from friends or relatives within the community (bonding)	20.0%
HH member migrated for work	19.0%
Relied on remittances from a relative that migrated	19.0%
Unconditional gift of money (not remittances) or food from family, friends, church, or other group within community (bonding)	17.0%
Sending livestock in search of pasture	16.0%
Got food on credit from a local merchant	15.0%
Took up new/additional work (casual labor, wage labor)	13.0%
Took out a loan (no interest) from friends or relatives outside of the community (bridging)	13.0%
Received emergency food aid from the government or NGO	11.0%
Received emergency cash transfer from the government or NGO	11.0%
Unconditional gift of money (not remittances) or food from family, friends, church, or other group outside of community (bridging)	11.0%
Took children out of school	9.0%
Took out a loan (with interest) from an MFI or village savings group r. Took out a loan (with interest) from a moneylender	6.0%
Sent children or an adult to stay with relatives	6.0%
Slaughtered livestock	4.0%
Sent children to work for money (e.g., domestic service)	2.0%
Migrate (the whole family)	2.0%
Took out a loan (with interest) from a (formal) bank	1.0%
Leased out land	1.0%
Sold household items (e.g., radio, bed)	0.0%
Moved to less expensive housing	0.0%
Sold productive assets (e.g., plough, water pump)	0.0%
Sold household items (e.g., radio, bed)	0.0%

Table 20: Coping strategies

5 DISCUSSION

This report summarizes the results of an investigation to identify what ViM program impacts were sustained three years after the ViM ended in Kaya. The picture that emerges is mixed. A key sustainability strategy of ViM was to form groups and train community-based workers (CBWs) as leaders with the intention that these groups would become self-sustaining and that trained CBWs would continue to provide services after ViM ended. The expected motivation for this dynamic differed by type of group and by CBW type under each strategic objective (SO). ViM also

supported education of beneficiaries on economic activity, agricultural production, and health-related behavior, expecting the promoted practices would continue to be applied after exit based on the benefit experienced.

5.1 SO1

Under SO1, ViM identified and strengthened producer organizations (POs) during the program with the expectation that these groups would continue to meet, work together, and pool resources to purchase inputs and market products. At endline, membership in POs was below 10% for all crops except cowpea, sorghum, and ruminants. Between endline and follow up, membership in all the POs fell substantially, with only one crop (rice) having more than 10% of farmers reporting membership. Membership in a PO was significantly associated with product sales, but joint purchases of inputs or sales of produce did not exceed 10% of the producers of any crop at endline, and there was no significant change at follow up. This result is consistent with the endline observation that members of POs did not feel ready to operate independently, specifically, that they felt they needed more training and capacity building and (in many cases) more access to resources. This may reflect a need for more time to achieve the expected results (since strengthening of POs was in some cases implemented late in the program, and opportunities for outreach may have been limited). Training, capacity building, and establishing links to other (government or non-governmental) organizations might contribute to strengthening the POs, even without direct provision of resources. There was some concern that the worsening security situation between endline and follow up might have inhibited meetings of POs and thus decreased participation. This may be true, and some farmers in the qualitative investigation cited this as a reason. Our analysis found that farmers reporting an experience of terrorism were not less likely to belong to a PO, but fear of terrorism may still be a concern.

There have been some sustained successes. A goal of ViM was to encourage farmers to diversify their production; crop diversification was indeed increased during the program and continued to increase by the time of follow up. There were significant increases in the percent of farmers producing subsistence crops (sorghum, millet, maize, cowpea) and cash crops, including some not explicitly promoted by ViM (sesame, groundnut). In addition, since ViM ended, farmers report increased use of many of the inputs promoted by ViM, including a wide range of agricultural equipment as well as seeds, fertilizer and other agrochemicals, and improved livestock feed. However, limitations in the survey data do not allow us to determine the exact source of these inputs after the conclusion of ViM, and whether they were distributed free by development and aid programs, subsidized, or purchased at market value. Whatever the source of the materials, these results suggest that irrespective of PO membership, the benefit derived from these inputs was incentive enough to continue use when they were no longer provided or subsidized by the program. Not surprisingly, the adoption of most promoted agricultural and environmental practices was higher for farmers in a PO, since some of the same factors driving membership (e.g., greater area under cultivation) may also be associated with adoption of practices. Reported experience of terrorism or security concerns was associated with a significant reduction in the use of several practices.

The percent of farmers selling crops decreased significantly from endline to follow up. Much of the increased crop diversification was due to an increase in subsistence crop production rather than cash crops. Wealthier farmers, members of producer associations, and (controlling for other factors) women farmers were more likely to engage in sales. Despite reported concerns about

terrorism inhibiting market participation, those reporting an experience of terrorism were not less likely to engage in crop or livestock sales, though security concerns were cited by a significant number of those selling market garden cash crops (tomatoes and onions). In contrast to crop sales, livestock sales increased, however, and this is consistent with reduced livestock ownership at follow up and with the fact that farmers reported selling livestock as a coping strategy for dealing with agricultural and climate shocks.

Another sustainability strategy under ViM was to train community leaders. Under SO1, producer leaders were provided with agricultural inputs as motivation and in recognition of their contribution in leading Farmer Field Schools and training farmers; the expectation was that they would continue to provide services without remuneration out of a sense of commitment to the community and a desire to share the knowledge gained from their own training. At follow up, though, only about 25% of farmers reported knowing a producer leader, though of those, 78% said they received training or services from them.

The model for volunteer village vaccinators (VVs) was different: they were encouraged to become entrepreneurs and charge for veterinary and vaccination services, with the revenue providing resources to purchase vaccines and other supplies as well as a source of income that would motivate them to continue working in the community. At follow up, about 28% of farmers knew a VV; of those, almost three quarters received services from them. The VVs received subsidized vaccines from ViM; once the program ended, they obtained vaccines at market price and needed to charge more as a result. That being true, the fact that a quarter of farmers at follow up reported getting vaccines from a VV suggests that for at least some, the model of sustainability worked. This could be due in part to the increased willingness of farmers to pay for tangible products such as vaccines as compared to extension advice, since the Burkinabè government (and subsequently ViM and other programs) have long provided extension advice free of charge.

These results suggest that POs may not have been fully ready to operate independently at the time of program exit and might benefit from training, capacity building, and establishing linkages with markets and with local organizations to provide resources. But these results, specifically the relatively low participation in POs even at the end of ViM, also raise questions about how to exploit the potential role of POs in promoting livelihoods and food security compared with the promotion of diverse crop production and specific input use that directly benefit farmers.

5.2 SO2

The value of household assets (domestic goods, transportation, and productive assets) increased after ViM ended, and this increase was driven by an increase in the value of domestic assets (household goods such as furniture and radios) and means of transportation rather than assets involved in agricultural production. An exception was livestock ownership, which declined after program exit. This result is consistent with a significant increase in reported livestock sales as well as reports that selling livestock (typically a repository of household wealth) was a coping strategy for dealing with economic shocks. With the value of livestock included, total household assets declined from endline to follow up.

Further, household diet diversity, one indicator of household economic well-being, declined over the course of ViM, and declined further in the years after exit. Experience of moderate to severe hunger at follow up, though, was well below the rate at baseline. (Comparison with the endline

survey is not reliable, since the EL was conducted in the harvest season, while baseline and follow up both occurred during the lean season.)

One strategy for achieving sustainable improvement in livelihood and income, SO2, was the formation of community groups called Savings and Internal Loan Committees (SILCs), intended to be a mechanism for funding small businesses as a means of improving income sustainably. Membership in SILCs declined substantially after ViM ended from about a third of households to about nine percent, and the number of households reporting small business as a primary revenue source fell over the same period. Reported receipt of training related to SILC also declined to negligible levels.

As is the case with POs, formation or strengthening of SILCs did not appear to result in their sustainability. An exploration of the reasons for their decline and the provision of relevant capacity building and establishment of linkages to local sources of credit could strengthen them and increase their longer-term usefulness. The other type of village savings and loan association (VSLA) established by VIM had linkages to the *Réseau des Caisses Populaires du Burkina* (Burkina Faso Credit Union Network, a government savings and credit union system) to provide a source of credit to these VSLAs. These groups would be expected to have a higher level of sustainability than the standalone SILCs, although the survey data collected do not explicitly differentiate between the two models.

Thus, the picture is mixed regarding the sustainability strategy for achieving SO2. While some indicators (domestic asset ownership, household hunger) improved, others did not. As with formation and strengthening of POs, participation in SILCs was not sustained once the ViM's support ended.

5.3 SO3

The prevalence of stunting in children under age five was reduced over the life of the program, attributed at endline at least in part to receipt of rations. Stunting rates rose significantly from endline to follow up, though still below the baseline rate. Underweight rates also were reduced during ViM, and this reduction was maintained at follow up. The quality of children's diets was measured in terms of minimum acceptable diet (MAD), comprised of minimum diet diversity and appropriate meal frequency; the percent of children achieving MAD was low (about six percent) at endline and declined slightly (though not significantly) at follow up; the low rate of MAD was driven more by diet diversity than by meal frequency, which was satisfactory for about a third of children. One well-sustained practice was that of putting a newborn to the breast within two hours of birth; this increased from about half to over 80%, and this was maintained (reached 88%) at follow up.

Use of health care services showed a mixed picture. The percent of children 12 – 23 months old who were fully immunized increased substantially during the ViM program, and this increase was maintained, with almost 90% fully immunized at follow up. Child receipt of vitamin A supplementation declined, however, and the percent of children with growth monitoring in the past six months fell to 60% though it remained above the baseline level of 45%. Similarly, the percent of women receiving at least four antenatal visits, which rose over the life of the program from about half to over 80% declined, though not to baseline levels, at follow up; the number of women receiving a postnatal check within two days of birth also declined; this same pattern was observed for receipt of vitamin A post-partum and receipt of iron/folate supplements, though at follow up

60% of women received at least four antenatal visits (and all women had at least one); the same percent received postnatal checkups, and almost 90% of women had received iron/folate in the past year. Declines in health service accessing observed between endline and follow-up may have been impacted in part by a lack of services available during the Covid-19 pandemic and the ensuing shutdown of government services and restriction on travel and gatherings.

Multiple strategies were implemented to achieve sustainability of the impacts related to SO3. ViM trained two sets of community-based health providers. Mother leader animators (MLA) were trained to provide growth monitoring, advice about childcare and feeding, and behavior change communication regarding hygiene and sanitation practices including the promotion of handwashing stations and construction of latrines. The MLAs organized care groups of mothers who would meet to participate in training sessions on these topics. The plan for sustainability was that MLAs would continue working in the community after exit, out of appreciation for the education they had received, and the respect of the community gained from their position. ViM also trained community-based health agents (CBHA) whose roles included providing community-based health care. These workers were intended to be integrated into the government health system and paid for their work at the end of ViM. This strategy has worked well for the majority of CBHAs. Qualitative investigations at follow-up suggested that at a minority of CBHAs were no longer being paid, and a subsequent quantitative survey of CBHAs trained by ViM in Kaya municipality showed that 81 percent of the CBHAs were being paid, while 19 percent were unpaid.

The distribution of rations of specialized nutritious foods to pregnant and lactating women and to children 6 – 23 months of age was a central component of ViM until September 2016, and at endline, these rations combined with SBCC activities on nutrition contributed to reducing the prevalence of stunting and underweight in children. Provision of free rations has no sustainability component, but the potential long-term benefit is in incentivizing caregivers to make use of health services and to receive training that will improve their health and nutrition practices to the benefit of future children.

The changes in the use of health care services may reflect the persistence of ViM sustainability strategies, as well as the ViM Partnership Defined Quality approach, which brings community members and healthcare workers together to find solutions jointly to increase access and demand for health services. During the life of the program, growth monitoring, vaccinations, and supplements were provided in the community by the health workers (MLA, CBHA) trained by ViM, and the expectation was that they would continue to provide these services after ViM ended. ViM provided supplements (though not vaccines) during the program but not after the program ended. For antenatal care, growth monitoring, and supplements, mothers and caregivers obtain these services from their local health centers, not all of which are within the community. Still, receipt of ANC at follow up was well above baseline levels. About 60% of women at follow up reported knowing an MLA, down from over 80% at endline, but at follow up, 18% of those who knew an MLA reported getting services from her.

Provision of supplementary rations is an important component of USAID-supported food assisted development programs, and it was the case for ViM and for MYAPs in general; rations provided by ViM reached 60% of children and over 40% of pregnant or lactating women targeted by the program at endline, and was credited at endline with the significant reduction of stunting achieved over the life of the program. Provision of free rations of course is not subject to any sustainability strategy, but one expected benefit is incentivizing mothers to make use of health services and, in

conjunction, receive training in IYCF and other health-promoting practices. The termination of rations may be an additional factor in the decline of health service use (antenatal care, growth monitoring, supplements), although note that distribution of rations ended in September 2016 before ViM endline. As such, other activities such as ViM SBCC efforts and community participation may have also contributed to reductions in stunting, in combination with the food rations distributions.

MLAs were also responsible for providing education and behavior change communication on topics of health, nutrition, and sanitation. Report of receiving training in these topics declined significantly from endline to follow up, falling to between 7% and 16% from a quarter to a third at endline. These trainings could have been received from other sources than MLAs, but the overall picture is that such training was less available after ViM ended. Presence of a handwashing station with cleaning agent fell, and the percent of caregivers able to describe the critical moments of handwashing fell as well, but at 23% was still substantially above the baseline rate. The presence of improved sanitation facility rose dramatically from endline to follow up, suggesting the possibility of a new program in the area promoting latrine construction.

5.4 Cross-cutting: Gender

The two indicators of impact under this objective were women reporting they participate in household decision-making and women disagreeing with a husband's right to hit his wife under some circumstances. The decision-making indicator showed disappointing results on sustainability: women's reported participation in decision-making rose during the program but fell to below baseline rates at follow-up. On the question of gender-based violence, there was substantial improvement over the life of the program; acceptance of such violence increased somewhat at follow up but remained well below baseline levels, showing a positive long-term effect. Other measures of women's participation in economic activity indicated a greater likelihood to participate in POs and in some cases a greater likelihood of selling crops, as discussed under SO1. Participation in women's groups, though, declined substantially, including women's economic group, women's empowerment group, and women's literacy group, all of which had participation rates below three percent of women respondents at follow up. Care group participation was around six percent. Women's participation in agricultural groups fell from over half to 14% over that time. Women's receipt of training on childcare, WASH, and nutrition was below 10% at follow up. As with POs and SILCs, membership in these groups fell significantly once ViM's support was withdrawn, although it is not possible to determine whether groups ceased to exist or continued to exist with lower membership.

5.5 Cross-cutting: Environment

Farmers reporting the use of environmentally sound practices rose over the life of the program but declined by the time of follow up, though a substantial percentage continued to report using at least three environmentally sustainable practices and at least two environmental mitigation principles. Environmentally sustainable practices targeted by the ViM program in its agricultural extension program with producer organizations include *zai* pits, half-moons, stone barriers in fields, soil stabilization using grass, farmer-managed natural regeneration, agroforestry, and gully treatment, among others. These practices are intended to restore soil health, prevent erosion, conserve groundwater and surface water resources, increase agroecosystem biodiversity, and maintain habitats for key animal and plant species. Some of these practices were still being used at high rates at follow-up, although others declined, likely due to lack of resources and materials

needed to maintain the practices or implement them on new fields (e.g., carts for transporting stones for stone barriers).

5.6 Exposure to Shocks and Evidence of Resilience

Sustainability to some extent depends on a level of stability in the economy and the society. Between endline and follow up, Burkina Faso experienced a range of shocks and stresses that could have a substantial impact on the sustainability of program activities and benefits. In qualitative investigation, shocks related to the current security situation were widely cited (terrorism, violence, and related, influx of displaced persons). These shocks were reported in this quantitative data as well, but the most frequently reported shocks – cited by almost 80% - related to climate and to agricultural production (excess rainfall, drought, pests, and disease). Experience of terrorism was far less common as was the experience of challenges due to an influx of displaced persons, both at about 20%, although fear and anxiety related to security were common concerns expressed in the qualitative investigation. As a result, the coping strategies reported by households largely had to do with managing reduced income by economizing and reducing consumption including, for some, food consumption. Selling livestock was another common coping strategy, but the most extreme coping strategies – selling off agricultural equipment, sending family members away, or migrating – were uncommon. The majority of household respondents said they were able to recover from the shocks they had experienced– defined as being able to meet their food needs – or even improve their situation compared to what it had been, suggesting a promising level of resilience.

5.7 ViM Sustainability Strategies

The sustainability strategies embedded in ViM fell into three categories. One was the formation or strengthening of groups of beneficiaries with the expectation that the benefit of group membership would motivate beneficiaries to continue meeting. In the case of POs and SILCs, the expected benefits were financial: group sales and input purchases, loans to support the establishment of small businesses (as well as increased access to savings instruments and access to a “solidarity fund” for emergencies). In the case of women’s groups related to health and nutrition and those related to economic issues, empowerment, and literacy, benefits were knowledge, self-efficacy, and mutual support. Care groups formed by the program were led by MLAs and intended to provide education on health, nutrition, and sanitation, as well as social support, skills building, and individual support during home visits. Three years after ViM ended in Kaya, participation in these groups had fallen to levels below ten percent, in some cases in the 2 -3 % range, but in many cases, notably among producer organizations, participation even at the time of the endline evaluation was quite low, suggesting barriers to participation – whether lack of motivation or something else – that need to be addressed along with assessing the potential benefit. Qualitative investigation at endline suggested that groups formed by ViM may not be ready to sustain themselves without further support, training, and resources, and these results confirm this.

A second strategy was to train and support service providers with the expectation that they would continue to provide those services without program support. The success of this strategy was mixed, with evidence of a decline in the number of beneficiaries reporting that they knew one of the service providers or had received services from them. The model of expecting service providers to continue working without support or remuneration based on the appreciation or respect they would receive is flawed in that competing demands on the time of these providers threaten their ability to continue organizing meetings or reaching out to individual beneficiaries (although in the

qualitative investigation, people said they would always be willing to provide advice if someone came to them and asked). The model of the VVVs, though, was to establish them as entrepreneurs; some clearly were still offering veterinary services at follow up, though the percent of farmers using their services had declined, and the VVVs cited a lack of equipment (refrigeration) as a barrier to their continued operation.

A third strategy was to provide education to beneficiaries. The long-term effects of education and training of beneficiaries were attenuated. A few specific practices were well maintained, while application of many others declined. Evidence of reduction in diet quality at the household, woman, and child levels likely reflects economic constraints rather than lack of knowledge, however. At the same time, practices such as crop diversification and the use of many of the promoted agricultural inputs were not only sustained but increased after exit, suggesting that identifying the appropriate practices, at least where they can return a profit, can increase, and sustain uptake.

There is substantial evidence that ViM is not the only source of support for farmers in Kaya. On a wide range of variables, farmers reported very substantial increases in support, including crop and livestock inputs, agricultural equipment, and other benefits related to crop and livestock production. At follow up, 27% of farmers reported getting support from an organization other than ViM, up from under three percent at endline and much lower than the percent reporting these other benefits, which was well over half for crop and livestock inputs. Whether or not the receipt of these benefits can be considered ‘sustainability’ in the sense that they are the result of self-reliance in the community, this suggests that people in beneficiary communities may conclude that they can depend on outside resources irrespective of one particular program. Notably, the benefits that saw these significant increases were largely material goods; receipt of training declined or stayed at quite low levels between endline and follow up.

6 RECOMMENDATIONS

6.1 *Expanding poultry and livestock vaccines (and the VVV role)*

Whether or not participants specifically knew a VVV who had been trained by ViM, the increased rates of farmers reporting vaccinating their poultry and livestock is promising; it suggests that people are seeing the advantages of vaccines. To further strengthen adoption of routine vaccinations and VVV’s success in their role, current VVV trainings should include workshopping ways to communicate local farmer success stories, especially considering that farmers’ predominant source of information on agriculture and marketing was reportedly from other farmers. While radio broadcast activities may be beneficial during the course of a program, the sustainability of these activities appears to be low post-program, and less than 2% of farmers reported this as a source of information they were using at follow-up.

In the qualitative investigation conducted in 2020, VVVs noted that they lacked resources (specifically, refrigeration) to keep vaccines fresh once a vial had been opened, and that the vials contained too many doses for them to use before they expired. Orienting VVVs towards scheduling group/village vaccine days at appropriate intervals (according to vaccine recommendations) over the course of a year may be an effective strategy to mitigate this issue. Effectively scheduling vaccine days in this way would also help VVVs understand whether this role is indeed lucrative enough to be their livelihood, and also to help them understand how much time to devote to the

role. The forthcoming service providers survey may shed light on what factors determine whether lead farmers and VVVs continued or stopped providing services.

6.2 Sustaining organizations

Producer organizations can be an effective approach to help producers pool labor and resources to implement new practices, increase productivity and marketing capacity, and build social capital. Developing and supporting POs was a central sustainability strategy of ViM, and it was surprising to see that these activities decreased significantly. In the qualitative findings, participants described barriers to continued engagement in producer groups. Prominent challenges included a lack of sustained support from local institutions and lack of official recognition for those organizations which did not convert to the OHADA-mandated model, a process for registering cooperatives officially with the Burkinabè government as a Limited Cooperative Society (*Société coopérative limitée*, SCOOPS) or a Cooperative Society with a Board of Directors (*Société coopérative avec conseil d'administration*, SCOOP-CA). Additionally, some organizations faced barriers to mobilization and gathering related to terrorism and COVID-19. The most surprising finding in this quantitative research was that membership in SILCs (savings groups), which were established with the support and facilitation of local micro-credit organization *Caisse Populaire*, was also quite low. A critical line of inquiry is to follow-up with *Caisse Populaire* to assess if their activities in Kaya Commune have changed, and if so, why. It would also be important to follow up with the Burkina Faso Ministry of Agriculture, Livestock, and Fishing (*Ministère de l'agriculture, des ressources animales et halieutiques*, MAAH) to assess what factors explain the low and decreased membership in organizations, including the abovementioned process of converting organizations into SCOOPS or SCOOP-CA: 1) difficulties converting to the SCOOP model; 2) current experience of attrition or fluctuation in membership; 3) availability of material resources and external linkages needed for the continued functioning of these organizations; 4) current levels of training and assistance.

An important element of supporting producer organizations and individual farm households involves resolving issues that prevent continued adoption of good agricultural practices and environmental protection measures, as adoption rates declined for many of these practices between endline and follow-up. It is essential to determine the constraints to continued adoption and whether they are tied to lack of motivation, lack of technical capacity for implementing these techniques, or insufficient access to financial resources and materials necessary for adoption. Sustaining environmental practices is essential to ensuring long-term sustainability of agricultural extension programs, as the continued vitality of agricultural production systems relies on protecting biodiversity, soil health, water resources, and provision of ecosystem services.

6.3 Selling livestock as a coping strategy

Several people reported selling livestock as a coping mechanism to manage shocks and stresses. This is a common coping strategy; livestock are often considered a “living savings bank” of sorts. However, considering that ViM provided certain livestock as a form of remuneration for ViM-trained beneficiaries including MLAs, it raises concerns for the usefulness of this approach to sustainability. Important areas of inquiry include: 1) what type of livestock are typically sold as a coping mechanism, 2) who is making the decisions to sell, and 3) who in the household is considered the “owner”.

6.4 Community provision of health services

The mixed picture of sustainability of the use of health services such as growth monitoring and the provision of supplements, along with the apparent decline in activity of MLAs, suggests the need to investigate what levels of support are needed to ensure community-based provision of these services and from where such support could be obtained. That there was close to universal receipt of complete vaccination and almost universal receipt of at least minimal antenatal care suggests there may be a successful model on which to build. (More information on the continued service of MLAs and CBHAs can be found in the service providers survey report.) Another recommendation involves fostering continued conversations and collaboration between community members and CBHAs/health center staff, given that positive results in this arena were observed under the Partnership Defined Quality approach used by ViM.

Additionally, programs could train CBHAs to reinforce their capacities to monitor and support GASPA, given that this task lies within the scope of their work, and they are currently being paid by the Burkinabè Ministry of Health. Under such an approach, technical support could be provided by the program during the initial training period, as part of the Ownership Transition Plan.

7 CONCLUSIONS

The mixed picture of sustained activities and impacts raises questions about the sustainability strategies implemented under ViM. There were several well-sustained behaviors. In the agricultural sector, these included a high rate of crop diversification and many cases of increased use of agricultural equipment and improved inputs; in the health sector, breastfeeding within the first hour and obtaining complete vaccination for children were sustained. But many indicators showed a decline, including agricultural sales, household diet diversity, women's diet diversity, child stunting and diet quality, and use of health services.

The strategy of forming groups – producer organizations, savings and internal lending committees, care groups – showed disappointing results. Motivation was apparently lacking to remain in such groups once the organizing force of ViM was absent and there could be no expectation of benefits from the program. Participation in all such groups fell to low levels; in the case of producer organizations, even at endline participation was generally not high, suggesting barriers separate from issues of sustainability. The sustainability model of establishing or strengthening producer or savings and loan organizations has had success in other settings, where profit provided the motivation and resources to continue applying skills and management expertise learned during a development program. In addition to profit, ensuring sustainability also requires an improvement in resilience capacity among former program beneficiaries. Whether the barriers to sustainability in the context of Burkina Faso lie in the deteriorating climate and security situation, insufficient benefit due to market conditions, or socio-cultural factors, this model needs to be re-assessed, perhaps modified, for its applicability to that context.

The strategy of training community service providers who were then expected to continue their work after program exit had mixed results. In the agricultural sector, village vaccinators were trained to provide services on a small business model. Though fewer farmers obtained vaccines from the VVV at follow up than at endline, these service providers were still a source for about a quarter of farmers. Some specific challenges – the quantity of vaccine in a single vial, the lack of refrigeration – might be remediable and increase the number of working VVVs. The evidence suggests that producer leaders reduced their provision of services after exit and ceased to run

farmer field schools. This decline may be due to the fact that these producer leaders were no longer receiving incentives such as free or subsidized agricultural inputs, reducing their motivation. MLAs also received benefits during ViM that were no longer given after exit, and the reduction of MLA activity is reflected in the steep decline in reports of health and nutrition training and care group meetings. The decline in service provider activity when incentives and remuneration are withdrawn has been documented in a wide range of settings. A forthcoming survey of service providers will provide more detail on this issue.

Persistence of behavior change as a result of beneficiary training was also mixed. Adoption of some good agricultural practices and improved inputs remained high at follow up; use of others declined. Qualitative investigation suggested practices that did not require expenditure or group labor were more likely to be sustained, but most farmers who used improved inputs cited increased production, consistent with the fact that larger land area and crop sales were predictors of uptake. The consistent decline in indicators of diet quality is as likely due to constrained income and decreased production as to lack of knowledge, but this is not the case with knowledge of sanitation practices. The lesson here is that behavior change needs reinforcement; education is valuable, and skills and knowledge can be maintained if they are continuously applied, but mechanisms for continuation of behavior change communication are likely needed for the behavior change to persist.

Sustainable change is not easy. Activities initiated under the program may have been affected by external conditions including climate shocks, insecurity due to terrorism, and the pandemic. The timeline for achieving change may be unrealistically constrained. Sustainability strategies that depend on establishing linkages with local partners need to be based on a realistic assessment of those partners' motivation, capacity, and resources to facilitate continuation of the services they are intended to support. Giving free resources is inherently unsustainable, but temporary provision of subsidized inputs may give beneficiaries the opportunity to experience benefits that will motivate them to obtain these inputs on their own at market price, if in fact those benefits are realized. The experience of ViM demonstrates that models that have been successful in one social, environmental, and economic context may need adaptation or simply not be applicable in a very different setting. The assumptions underlying these models need to be assessed critically based on local conditions during the design and modification phases of interventions and on an ongoing basis throughout the life of the activity.

One lesson from the ViM experience is that practices and behaviors that are feasible and valued can indeed be sustained and expanded. Practices whose benefit is not recognized or whose promise of profitability is not realized, however, are unlikely to persist, though they may be adopted while external actors from the development program are organizing and incentivizing them. Ultimately, the long-term sustainability of behaviors and activities that result in sustained impact depend on the experience of the communities themselves and on the community's own perception of their value and benefit. Sustainability also depends on regular support and motivation from key resources such as ViM and other similar development programs, or from government stakeholders and partners. If these various stakeholders have a close working relationship from the beginning of the program, responsibilities for supervision and support can be gradually handed over to government entities closer to program closeout.

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