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Scaling up women's agripreneurship through public-private linkages to improve rural women's income, nutrition and the effectiveness of institutions in rural Ghana (*Linking Up: Women's Agripreneurship Sustainability and Scale-Up project*)

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2 List of Acronyms

NLP	Nutrition Links Project
DAD	District Agriculture Department
SO	Specific Objective
FBO	Farmer Based Organization
LMKM	Lower Manya Krobo Municipality
UMKD	Upper Manya Krobo District
YKM	Yilo Krobo Municipality
AEA	Agriculture Extension Agent
IDI	In-depth Interview
FGD	Focus Group Discussion
IGF	Internally Generated Funds
GHS	Ghana Health Service
BAC	Business Advisory Centre
GES	Ghana Education Service
UMKRB	Upper Manya Kro Rural Bank
RCT	Randomized Controlled Trial
TIPS	Trial of Improved Practices
IT	Information Technology
ToT	Trainer of Trainers
QES	Queen Elizabeth Scholar
Pro-WEAI	Project-level Women in Agriculture Empowerment Index
INT	Intervention Group
COM	Comparison Group
DD	Diet Diversity
OW	Overweight
OB	Obesity
NS	Non-significant
BMI	Body Mass Index
NBSSI	National Board for Small Scale Industries
IDRC	International Development Research Centre

3 Executive summary

Over one-third of rural Ghanaians live below the poverty line, with women and children living in poverty having the highest risk of poor nutrition and health. Sustained integrated approaches that increase agricultural productivity and value addition, diversify incomes, and enhance knowledge and skills among all stakeholders, notably women are required to improve the well-being of rural communities. The Scaling up women's agripreneurship through public-private linkages to improve rural women's income, nutrition and the effectiveness of institutions in rural Ghana project (*Linking Up*) is a follow-up study to build on the results of the Nutrition Links project (NLP) funded by the Canadian Government (2013-18). The NLP's multi-sectoral integrated livelihoods, nutrition, agriculture and health intervention with rural women groups in the Upper Manya Krobo District (UMKD) of the Eastern Region decreased household food insecurity, increased women's access to income, and improved young children's diets and nutritional status. However, efforts to sustain the intervention through multisectoral collaborations by local institutions were unsuccessful due primarily to the lack of integration of sustainability mechanisms into the regular operations of the local institutions.

The goal of the *Linking Up* project was to explore mechanisms for sustaining similar integrated services to those delivered by NLP for women in agricultural livelihoods (agripreneurs), and extending those services beyond the NLP communities (i.e. scale up). The overall objective of *Linking Up* was to improve the quality of life of rural Ghanaian women engaged in agricultural livelihoods and their families. The specific objectives were to: 1) determine the factors that facilitate or impede women's participation in farming and agri-food entrepreneur associations that are/can be supported by local institutions; 2) test gender transformative approaches that improve outcomes for both women agripreneurs and institutional stakeholders; and 3) assess the steps of integration of effective approaches into permanent programs and scale-up to new programs and districts.

In this report we note factors identified that facilitate or impede women's participation in farming and agri-food entrepreneur associations supported by local institutions. By testing gender transformative approaches our study also highlighted some approaches to engage institutions to work collectively to improve outcomes for both women agripreneurs and institutional stakeholders. Further, our study highlighted challenges faced in taking steps to integrate effective approaches into permanent programs and scale-up to new programs and districts. Such challenges include the length of time it may take for such interventions to become embedded in institutions, and processes specified and measured in existing institutions, to inform decision makers about progress being made, and aspects to be modified for success. We elaborate on these below, and further in the report, beginning with some context of the project, key findings, and emergent issues to be addressed.

During the projects inception meeting institutional stakeholders from the NLP, who were from Upper Manya Krobo District (UMKD) contributed to decisions about the selection of Yilo Krobo Municipality (YKM) and Lower Manya Krobo Municipality (LMKM) as scale up municipalities. They also contributed to the approach of targeting interventions to women in Farmer Based Organization (FBO) established by agriculture extension staff, to facilitate integration interventions into the regular operations of Department of Agriculture (DAD) as lead institutional partner.

Participatory engagements with institutional stakeholders facilitated selection of women in FBOs in the three study districts for intervention planning. Activities associated with the first specific objective included qualitative assessment of gender inequalities in institutional services and quantitative assessment of differences in women who join farmer associations and those who do not. Gender related inequalities in services stemmed primarily from i) inadequate institutional resources (especially funding), disproportionate targeting of available agricultural support opportunities to typically male dominated activities, unfavourable bank loan facilities, cultural norms that hinder women's effective engagement with the bank and other formal institutions, and personal factors such as limited educational attainment. Quantitative findings showed that women FBO members and non FBO members generally had similar characteristics: Less than

one-third of women had a bank account, their main agricultural activity was staple crop farming, majority of the women lived in food-insecure households and consumed a monotonous diet in the past week, and overweight was prevalent among the women.

Together with institutional stakeholders we engaged with the selected FBO to select agricultural enterprises of interest to the women, and which were determined as viable through cost analysis. We then developed intervention packages comprising a repayable inputs loan scheme for engaging in selected activities (intensive poultry [layers] husbandry or vegetable [local eggplant]) to be sustainably coordinated as a revolving fund scheme for the women with support from local institutions including the rural bank. Using a quasi-experimental design and a staggered two-phased implementation schedule, the intervention reached 166 women in eight communities. A 100% repayment rate by phase 1 participants enabled reinvestment of funds for phase 2. An integrated capacity strengthening package at institutional and communities levels using the Trainer of Trainer approach for institutional personnel, who would then train women at community level. Regular FBO meeting times provided a platform for multisectoral service delivery by the different institutions. Process data showed nearly two million poultry eggs and 80 thousand kilograms of local eggplant produced over the intervention period by the women, most of which (up to 99%) was sold for income. However, only the lead institution (DAD) and the rural bank engaged somewhat regularly (20% to 60% of all institutional engagements) with the women for provision of education and other services; there was minimal engagements (less than 10% of all institutional engagements) by other partner institutions such as Ghana health Service (GHS), Ghana Education service and Local government departments. Baseline and Endline survey data occurred before intervention initiation and 12 months post initiation, respectively. Variables of interest included women's empowerment in agriculture, household food security, dietary intake and women's nutrition status. Institutional stakeholder representatives rated the project's capacity strengthening activities on the basis of overall benefit, new knowledge gained and improved services and also shared their opinions about the sustainability strategy adopted.

After adjusting for possible confounders, the odds of being empowered was 1.7 times higher for the intervention women (INT) compared to those not receiving the intervention (comparison group [COM]) (aOR= 1.74; 95% CI [1.02, 2.93]). Being empowered at endline was associated with a reduced likelihood of being moderately and severely food insecure (aOR=0.41; 95% CI [0.17, 0.96] and aOR=0.19, 95% CI [0.07, 0.51], respectively). Furthermore, assessment of differences in levels of food security (food secure, mild insecurity, moderate insecurity, severe insecurity) showed that almost one-half (46%) of INT households improved in their food security status compared to only 36% of COM households that did so ($\chi^2=10.27$; $p=0.016$). However, using the dichotomous (food secure vs. food insecure) variable, being in the intervention was associated with a two-fold increase in the likelihood of being food insecure at endline compared to the COM group. (aOR=2.122; 95% CI [1.01, 4.44]).

The mean dietary diversity score significantly increased among the intervention women (4.8 ± 1.5 at baseline vs. 5.2 ± 1.4 at endline; $P=0.060$) but the prevalence of women who consumed adequate diet diversity (ie., consumed a diet with at least five food groups) was not different between baseline and endline. Only consuming adequate diet diversity at baseline significantly predicted having adequate diet diversity at endline (aOR=2.4; 95%CI [1.1, 5.2]). The lack of intervention effect on dietary improvement may be attributable to the limited community engagements by the GHS with diminished opportunities for the women to receive nutrition education to improve their dietary behaviours.

Anthropometric results showed that about 43% of these rural women were either overweight or obese compared to only 16% of their male household members being overweight or obese. Qualitative data suggested that the project participants did not recognize overweight as a health concern and discussed serious health considerations, such as stroke, only for the highest (obese) body sizes.

Institutional personnel generally gave well above average ratings (between 6-9 out of 10 total) on the overall benefit and contribution of the Linking Up project's institutional capacity strengthening activities to new knowledge and improved services. Of note was the assertion by a GHS representative that '*The research Linking Up shared with us on obesity [in the communities] was eye opening. It has led us to increase our messages on obesity prevention in the communities*'. This is an important outcome that could

help increase community awareness about overweight/obesity as a serious health issue to counter the current apathy towards addressing the condition both at institutional and community level. Institutional stakeholders expressed concerns about their institutions' commitment and resource capabilities to support sustainability plans. Sustainability was at the core of the project's inception and implementation activities. Our exit strategy involved establishing a revolving loan fund with the partner rural bank and with oversight responsibilities by multisectoral institutional committees. Lack of commitment and funding for normal operations by institutional staff is a threat to sustainability.

The Linking Up project design was based on the collective impact approach, with the notion of different institutions working together to address a specific social problem of mutual concern. Our intervention packages supported nutrition-sensitive activities through three key pathways: (i) home production (poultry and eggplant) with positive trend toward more diversified household diet; (ii) increased income, and (iii) women's empowerment which was associated with improved food security. Over the two years of the project, the 132 women that focused on poultry sold over 1.8 M poultry eggs with an approximate value of ~US\$180,000 (assuming an average of about US\$3 per crate), primarily in the regional markets. The 33 women who produced garden eggs, sold over 63,000 Kg at a value ~US\$124,000 (assuming a value of US\$2 per kilo) in the regional markets - obtaining good prices because of their ability to sell the crop when the supply in the market was low. The Linking Up project thus stimulated an increase in annual income of about US\$300,000 for 165 women, on average ~US\$1800/. The intervention women thus contributed a high-quality animal source food product (eggs) and increased off-season availability of local eggplants to the food environment in their communal and regional marketplaces. Good loan repayment performance by the women not only facilitated the establishment of the revolving fund, a key feature as part of the project's sustainability strategy, but also established the women as being credit worthy. This has resulted in the bank looking for opportunities to do business with the women and so removing the gender-related barrier to formal credit, identified at baseline. Besides the rural bank the success of the project's community interventions has motivated other institutions to become interested in working the project communities. For example, KROBODAN, an NGO operating Eastern Region Capital, Koforidua, engaged one of the horticulture groups to discuss an opportunity for collaboration on a new project to support landless crop farmers. Beneficiary selection in future projects should be informed by the self-reported behaviours of women identified as 'more successful' which included active participation in intervention activities, sound financial management with avoidance of impulsive spending, and saving money. While 'more successful' women described their plans for self-investment to continue their enterprises after the intervention, a woman identified as less successful expressed expectation of continued project support. At institutional level, the project fostered multisectoral collaborations, and despite a myriad of challenges, particularly with COVID-19. Our continuous engagements led to mutual learning that directed both the project team and local institutions to explore new directions that could potentially influence policy and or strategies. For example in one of the study municipalities the DAD adopted the project's loan concept to pilot a poultry intervention with a few in a new community using the institution's own funds which was a deviation from their normal way of providing agriculture inputs without expectation of recouping the investment with opportunity for scale up and sustainability beyond initial recipients. Another example is the partner rural bank expressing interest in expanding its microfinance coverage to new communities targeting women farmers, motivated by the intervention women's loan repayment performance. The institution of the revolving fund to be coordinated by the multisectoral oversight committees sets the stage for local institutions to continue to work collaboratively in enhancing women's livelihoods and household wellbeing in the Eastern region.

4 The research problem

Traditionally, women farmers have been an underserved community. They experience challenges in accessing needed capacity and financial support to enhance their livelihoods for improved income as well knowledge and skills to improve their nutrition and health and that of their households.

The *Scaling up women's agripreneurship through public-private linkages to improve rural women's income, nutrition and the effectiveness of institutions in rural Ghana* project (*Linking Up*) is a follow-up study of the *Nutrition Links* project (NLP), funded through Global Affairs Canada. The NLP was a multi-sectoral integrated livelihoods, nutrition, agriculture and health initiative which among other interventions, included a 12-month cluster randomized controlled trial to enhance child nutrition and household diet through support for home gardens and poultry husbandry and facilitated nutrition education to mothers. Compared to controls, intervention households had decreased food insecurity, increased women's access to income, and improved diets and nutritional status among children. At the end of NLP, a multi-stakeholder committee headed by the Department of Agriculture (DAD) was formed with the goal to sustain the achievements of the intervention. This initiative was unsuccessful, due primarily to the lack of integration of committee activities into the regular workplan of the committee members' institutions. The goal of *Linking Up* was to explore mechanisms for sustaining integrated services (such as those delivered by NLP) for women in agricultural livelihoods (agripreneurs) outside of the context of a carefully controlled project. The overall objective of *Linking Up* is to improve the quality of life of rural Ghanaian women engaged in agricultural livelihoods and their families. The specific objectives (SO) were to:

1. Determine the factors that facilitate or impede women's participation in farming and agri-food entrepreneur associations that are/can be supported by local institutions.
2. Test gender transformative approaches that improve outcomes for both women agripreneurs and institutional stakeholders.
3. Assess the steps of integration of effective approaches into permanent programs and scale-up to new programs and districts.

We employed participatory and iterative processes in addressing these objectives. Findings for SO1 informed the development of the two-phased implementation (using a quasi-experimental design) of two livelihoods-strengthening and capacity-building intervention packages with women farmers in farmer-based organizations (FBO) for SO2. A central theme of the project has been fostering and strengthening local institutional capacity to support implementation and continuous supervision of these collaboratively planned interventions. Further, there were aspirations for institutional collaborations to facilitate the sustainable and holistic provision of services that strengthen capacities of women farmers to empower them to not only have successful businesses but also improve their own nutrition and well-being as well as that of their households.

5 Progress towards milestones

5.1 Overall Objective

These milestones were administrative setup, ethical approvals and an inception workshop.

5.1.1 Administrative set up

The administrative set-up was completed in the first 18 months, filling staff positions for the organizational and communication structure. Ghana administration, management and oversight were supported by 21 staff (9 full time and 12 temporary enumerators). Student investigators (McGill: 5, UG:1) also contributed to administration, field coordination and project management.

5.1.2 IRB applications completed and submitted (100% achieved):

The study protocol received ethical approval from the Ethics Committee for Basic and Applied Sciences at the University of Ghana (ECBAS 035-18/19) and the Research Ethics Board at McGill University (377-0219 and 19-10-043); approvals were renewed each year. All modifications associated with minor protocol changes to include new objectives or participants (student research) or for adapting methodologies to the field context were also approved.

5.1.3 Inception meeting (100% achieved):

A two-day inception workshop (November 6-7, 2018) in Koforidua (Day 1) and the University of Ghana's Nutrition Research and Training Center (NRTC) in Asewewa (Day 2). The workshop brought together key multisectoral institutional stakeholders (health, agriculture, education, and community advocacy) associated with the NLP to deliberate on Linking Up's objectives. The outcomes were consensus on the general scaling-up, implementation, and sustainability strategies to be adopted for the Linking Up project. The scale-up strategy included i) geographic expansion to municipalities (Lower Manya Krobo Municipality [LMKM] and Yilo Krobo Municipality [YKM]) contiguous to UMKD where NLP was implemented and ii) increased number of beneficiaries reached (i.e., during the project term and instituting sustainability mechanisms that allow for continued expansion beyond the project period). The implementation and sustainability strategies comprised: i) mainstreaming intervention packages and beneficiary selection processes within the normal operational structures of local institutions and ii) instituting mechanisms and structures for continuity and expansion. Specific implementation processes agreed on included selecting beneficiaries (women farmers) from existing farmer-based organisations (FBO) formed through the agricultural extension services in each locale.

5.2 Specific Objective 1 (SO 1)

These milestones included i) secondary analyses of NLP data to identify individual and social factors that influence women's participation in farmers' entrepreneur associations, ii) cross-sectional survey of potential beneficiaries in scale-up municipalities, and iii) qualitative assessment of factors that impede women's participation (with emphasis on gender-related factors) in farming entrepreneur associations that are/can be supported by local institutions.

5.2.1 Secondary Analysis of Nutrition Links data completed (100% achieved).

We hypothesized that women's enrolment and active participation in associations are associated with individual characteristics (e.g., self-confidence) as well as organizational (e.g., functional association) and social/community/institutional factors (e.g., community leadership support). The secondary analyses of NLP data assessed differences between NLP participants who opted to be part of the NLP Apex Women's Poultry Association (n=234, 81.5%) and those who did not (n=53, 18.5%). Women who joined the association were more likely to: i) be of Krobo ethnicity, ii) live further from the capital (86.7% vs. 46.6%, $P<0.001$), iii) live in households that owned farmlands (78% vs. 50.9%, $P<0.001$), and iv) have a bank account (30% vs. 13.4%, $P=0.005$). Self-reported self-efficacy in taking decisions and actions was also higher among the association women (94.3% vs. 75.6%, $P=0.003$). Association members had higher parity (3.9 ± 2.5 vs. 3.0 ± 1.73 , $P=0.04$) and tended to have lower depression index score (6.7 ± 4.6 vs. 8.2 ± 5.2 , $P=0.07$). There were no differences in membership or leadership in other associations.

5.2.2 Cross-sectional survey in two contiguous municipalities completed (100% achieved)

Preliminary engagements were carried out with the institutions - District Agriculture Department (DAD); Ghana Health Service (GHS)/Municipal Health Directorate; Ghana Education Service (GES)/Education Directorate; District Assembly (DA); Business Advisory Centre (BAC); local NGO and Rural Banks – in the LMKM and YKM to introduce *Linking Up* and determine beneficiaries. We learned that DAD agricultural services to farmers were delivered through community-based, FBO formed by agricultural extension agents (AEA). Farmers may opt out of joining associations. It was agreed that project beneficiaries would be women in FBOs to use existing structures. The YKM and LMKM surveys were undertaken with women within the same communities who were either members of FBO (became intervention group) or non-members (became comparison group). To select the survey participants, AEA listed their active FBOs and those with at least 30% female membership were shortlisted and visited to gather information on the group's agricultural activities, scheduled meeting days, meeting attendance and meeting activities. Each shortlisted FBO was ranked (1-5) by the AEA on: i) members' participation ii) leadership, iii) congeniality, iv) ease of working with the group, v) group's need, vi) group's readiness to change, and v) potential to impact the group. Those that met at least twice a month, had $\geq 50\%$ average meeting attendance in the past four months, and had a high average AEA score were selected. Individuals in the comparison group were randomly selected from a census list of women farmers in the same communities who were not FBO members. The survey data were collected on 234 women and 154 men (in the same household) from April 1- 25, 2019.

Key findings: The women were farmers (91%), ~45 years married (67%), and undereducated (44% with no education). Their households did not own mechanized farm equipment and were food insecure (75%). Nearly half of the women were overweight or obese and on average had a diverse diet (five food groups per day). Non-FBO members were similar. Less than one-fifth and one-third of women had a bank account. The surveyed women were older than the participants of NLP as the latter targeted women with young children. The majority (> 65%) of all surveyed women municipalities reported having autonomy in crop production and input in productive decisions. However, having autonomy in income ranged from 47% to 63%. Their households owned land and other assets. While most had access to and made decisions on financial services, only 30% to 55% indicated that they had autonomy in income and autonomy in crop production. There were no differences between FBO members and non-members. We assessed women's access to institutional support. The women farmers reported having the most frequent interactions with AEA in the past year; more FBO members than non-members in both LMKM and YKM having interacted with an AEA. There were no group differences in interactions with other governmental institutions. In the past year, more FBO members than non-members across the two municipalities had interacted with a rural or commercial bank (35% vs. 18%; $P < 0.05$).

5.2.3 Qualitative assessment of facilitators/barriers to participation in associations with institutional key informants and women farmer entrepreneurs (100% achieved):

The qualitative assessment was guided by two questions: 1) What gender inequalities exist because of the context of the local organizations and community/institutions that have implications for the entrepreneurial activities and well-being of women farmers?; and 2) What organizational and community/institutional factors contributing to gender inequalities are modifiable to improve women's entrepreneurial activities and well-being? In April 2019, we completed in-depth interviews (IDI) with stakeholders from four institutions and four focus group discussions (FGD) with 41 women agipreneurs in UMKD, LMKM, and YKM.

Key findings: Institutional staff indicated general constraints to effective delivery of services to communities as opposed to barriers to women in particular. A central theme was the lack of funding and needed materials from the central government to implement activities (teaching aids and tools for demonstrations). Furthermore, poor road networks and insufficient logistical support (transportation and fuel) prevented effective engagement with communities. In some cases, institutional personnel identified a language barrier as a constraint because staff were not fluent in the local language(s). General challenges with accessing credit for farming livelihoods (rural banks typically do not give loans for farming) also

affected women farmers. In initial discussions, women were characterized as high risk. Loan repayment structures of the bank were seen as unfavorable to farmers. The different roles men and women play in agriculture appeared to be an indirect source of bias against women in the delivery of services because services were skewed towards men's activities, such as production, versus selling.

While institutional practices were apparently not specifically discriminatory towards women, institutional personnel and the FGD participants indicated that cultural and community norms and practices sometimes barred women from accessing services. Patriarchal beliefs in the communities which prescribe a subordinate position for women were perceived as major barriers. Other cultural issues that may hinder women progressing in their entrepreneurial activities were marriage, the demands of traditional roles in the home, the land tenure system, a negative perception of successful women, and the low educational attainment of women.

Suggestions to address the barriers included i) increasing institutional resources (staff, money), ii) logistical support for extension activities, iii) improving roads, iv) training personnel, v) auxiliary staff as interpreters, vi) increasing internally generated funds, vii) lobbying government stakeholders, viii) building inter-institutional collaborations, ix) instituting deliberate institutional policies to favour women, and x) flexible bank terms for loans and loan repayments.

5.3 Specific Objective 2 (SO 2)

Our second objective was to test approaches that enhance women agripreneurs' outcomes (knowledge, skills, empowerment, entrepreneurial success, nutrition/health) and institutional stakeholders outcomes (program participation/clientele reached, effective/efficient service, knowledge, skills, job satisfaction). Preparatory activities were undertaken at institutional level at the level of the FBO communities (Map of the study locale is provided in Appendix I)

5.3.1 Qualitative assessment of incentives and their importance (100% achieved):

Qualitative IDI on incentives and their importance for women's participation in associations were completed with 30 institutional staff from GHS, DAD, Business Advisory Center (BAC), GES, and UMKRB. The interviews focused on work motivations and incentives. Five FGD were completed with 54 women in FBOs. Data were collected between December, 2019 and January, 2020.

Key findings: Institutional staff identified financial (bonuses and allowances for transportation, training, overtime work, risk, and field demonstrations) and non-financial (Best Worker Awards, certificates of honour, capacity building opportunities, promotions, and verbal recognition by institutional leadership) incentives traditionally available through their institutions. . However, there were no traditional incentives specifically encouraging working with women. No additional incentives were suggested to encourage working with women. While institutional personnel indicated a preference for financial incentives, non-financial incentives were more commonly available through their institutions.

In the FGD, women discussed reasons for joining or not joining an FBO. Benefits of FBO membership included receiving education to sharpen farming skills, motivation to work hard, and opportunities to diversify their activities and sources of income. Women mentioned health benefits, receiving gifts, social support benefits, and being socially recognized for their hard work as incentives for membership. Reasons why some women did not join FBOs included living far from the meeting place, irregular community residence, lack of time, husband being a member of the FBO (so no need to join), lack of money (to pay dues), and not being hard working.

5.3.2 Training and IT needs assessment (changed to alternative activity).

COVID-19 lockdown restrictions disrupted the planned collaboration the McGill-UG Queen Elizabeth Scholars- Advanced Scholars program for this milestone. We carried out IT-related activities through the Trials of Improved Practices (TIPS: see 5.4.1).

5.3.3 Economic and education intervention development (100% achieved).

The aim of this activity was to develop and implement an integrated economic and education intervention package that is feasible within the context of permanent institutions, and self-sustaining. We envisioned capacity development that would result in improved knowledge, skills, entrepreneurial success, and nutrition/health of women agripreneurs and enhanced staff knowledge and skills, delivery of services, and work satisfaction at the institutional level.

Economic component: Using iterative participatory processes, we facilitated multisectoral institutional and community engagements to determine agricultural enterprises to promote as income-generating activities among women in the selected intervention FBO: poultry husbandry for eggs and horticultural support for garden eggs (local eggplant) production. In each study district/municipality, we completed a rapid financial feasibility assessment for the activities to facilitate costing and development of inputs loan packages. Inputs loan packages with loan repayment modalities were developed for poultry and vegetable production (See Appendix II).

Education component: This comprised of capacity building specific to the two value chains and educational support from institutions to address women's knowledge/information gaps (identified through stakeholder engagements and data collection) in entrepreneurship, nutrition, health, and other topical areas. Trainings specific to the intervention value chains were provided during a two-phase roll out of the interventions. The first phase was Trainer of Trainer (ToT) activities with agriculture personnel followed by a second phase of step-down training to the women/FBO by the trained personnel. The step-down trainings provided a platform for provision of educational messages (in health, education, banking, and/or entrepreneurship) by the non-agriculture institutions. Additionally, we facilitated participatory development of teaching aids and ToT workshops to promote household-level gender equity, financial literacy, nutrition/health, and messages development for e-education with institutional personnel.

Implementation: Delivery of the interventions included: i) preparatory capacity building of intervention participants to receive the inputs following baseline data collection; ii) inputs placement; iii) contracting signing for inputs received; iv) initiation of the loan cycle; iv) loan repayment (facilitated by rural bank personnel), supportive supervision (primarily by AEA), education/capacity strengthening (local institutions) during the regular FBO fortnightly meeting days ; v) twice monthly process monitoring and data collection (loan repayment, poultry and horticultural productivity) by project field assistants.

5.3.4 Community randomization (modified to quasi-experimental) baseline data collection (100% achieved).

With approval from our project officer, we changed the study design from an RCT to a quasi-experimental design to better reflect the study aims (integration into institutional programs), the limited funds available, and the reality on the ground (AEA support is given to FBOs, not individuals). We assigned treatment to the FBO (cluster) and women members self-selected to participate. Intervention delivery was staggered in two phases; one-half of the enrolled women received the intervention each year. As the FBO that chose the horticulture intervention included only 14 women, everyone received the package in the first year and two new FBOs were identified for Phase 2. The outcomes were contrasted between arm the intervention (INT) and comparison (COM) groups. The baseline data collection for Phase 1 and was November to December 2019 and November to December 2020, respectively.

Key findings: Within districts/municipalities, INT and COM participants had similar baseline sociodemographic characteristics. With the exception of the women in the UMKD COM group where the 64% reported being food secure, the majority of both INT and COM group women from the municipalities reported some level of food insecurity. Prevalence of women with autonomy in income, livestock production, and crops production was at least 50% from all study district/municipalities except for COM women in the LMKM, where fewer reported autonomy in income (58.6 vs. 84%, $P<0.05$) and livestock production (44.8% vs. 80%; $P<0.05$) compared to the women in the INT group.

5.3.5 Two-arm quasi-experiment: intervention package implemented, and intervention cycle initiated (100% achieved).

Two rounds (Phases 1 and 2) of inputs placements were achieved. The Phase 1 loan cycle was completed with 100% loan repayment enabling reinvestment in inputs loans for the Phase 2 beneficiaries. The Phase 2 loan recipients for garden eggs production (N=19, two FBOs) completed 100% loan repayment. Women in the Phase 2 poultry FBO experienced financial setbacks due to COVID-19 related restrictions on imports of poultry inputs and other economic factors, resulting in the tripling of input costs without an increase in the price of eggs. Thus, the groups asked for and received extensions in loan repayments. The groups have achieved 86% loan repayment to date with about 70% of them having completed their repayments.

5.3.6 Case studies of successful intervention participants completed (100% achieved)

This activity was completed at the end of the intervention for the Phase I women. The objective was to determine peer perceptions of successful intervention participation by the women and to document self-reported practices of women selected by fellow FBO members as having been 'more successful' or 'less successful' with their respective loans and enterprises. Based on the women's own selection criteria, two 'more successful' and two 'less successful' women were selected for interview. Additionally, one household member and one business associate of each case were interviewed. A total of 52 IDI ('most successful' women (n=12); 'less successful' women (n=10); household members (n=14); and business associates (16)) were completed. Interviews were analyzed using thematic content analysis.

Key findings: The women identified good financial management skills, ability to expand one's business, and ability to plan for future expansion as key success factors. Perceived traits of 'more successful' women included honesty, resourcefulness, being supportive of others and not being lazy; 'less successful' women had the opposite traits. Self-reported behaviours of women identified as 'more successful' included active participation in intervention activities, sound financial management with avoidance of impulsive spending, and saving money. While 'more successful' women described their plans for self-investment to continue their enterprises after the intervention, a 'less successful' woman expressed expectation of continued project support.

5.3.7 Endline data collection for the study (100% achieved)

We completed the endline data collection for the Phase 1 women concurrently with the baseline data collection for the Phase 2 participants from November to December 2020. Endline data collection for Phase 2 participants occurred May to June 2022.

5.4 Specific objective 3 (SO3).

Our third specific objective was to assess the steps of integration of effective approaches into permanent programs and scale-up to new programs and districts. Activities aimed to identify mechanisms to address community and institutional challenges that threaten sustainability.

5.4.1 Trials of Improved Practices (TIPS) (93% achieved)

These mini-trials were carried out on three topics: (i) mobile messages, (ii) virtual platforms for institutional collaborations and (iii) peer education. The aim was to address two major implementation challenges: i) inadequate institutional engagements with communities, and ii) limited inter-institutional collaboration/coordination to foster multisectoral holistic services to communities. Two trials explored using IT to support institutional engagements and the remaining trial explored the opportunity for capacity development for supplementary peer education. The activities and outcomes associated with each of the TIPS are summarized below.

Mobile Messages TIPS (100% completed): We tested the feasibility and acceptability of providing agriculture and nutrition information through mobile voice messages to women farmers in one district with high mobile phone ownership and self-reported access to mobile network. We collaborated with a technical service provider for information sharing and data collection via mobile technology (VIAMO) to facilitate a ToT in developing short educational messages to be delivered as voice messages. A three-week trial where an alert (special ringtone) was sent to the women's phones three days a week and an educational voice

message (up to one minute long) delivered when the call was accepted. Less than 30% of the messages could be delivered due to poor network connectivity. Other challenges included maintaining charged phones (lack of electricity) and personal challenges (inability to operate the phones, sharing phone with family). While there was limited success, FGD with the women suggested they were open to the idea of receiving information/education via their mobile phones. Furthermore, the capacity for content development for educational messages has been built among key frontline staff who can pass this training on to other frontline staff in other sectors.

Virtual platforms for institutional collaborations TIPS (100% completed): After establishing multisectoral institutional stakeholder sustainability committees in each study district/municipality we used the TIPS approach to assess committee members' perceptions on i) the utility of participating in the TIPS as a committee; ii) how using virtual platforms to communicate helped or hindered collaborations to achieve committee milestones. After completing a baseline questionnaire on their familiarity with different virtual platforms, the committee members participated in a training seminar on using Zoom and WhatsApp for communicating or meeting. Each committee was then given a weekly schedule of milestones to collectively accomplish with the support of virtual platforms. Data were collected on members' participation in weekly virtual debriefing sessions, engagements on committee WhatsApp platforms and use of virtual platforms for meetings. Through FGD, committee members reported that the TIPS activity enabled them to i) exchange knowledge; ii) enhance their knowledge about virtual platforms, iii) build stronger interpersonal relationships with their committee members, and iv) work as a team. However, there was limited virtual-based engagements among committee members. Participants reported that WhatsApp was more reliable than Zoom due to poor network connectivity. The general sentiment was that participation in the TIPS helped the oversight committees to engage with each other and begin working together, however, poor internet connectivity hindered their ability to effectively engage virtually.

Peer education TIPS (80% completed): The aim was to facilitate development of teaching aids to support training of peer educators to contribute to capacity strengthening of FBO members. Peer educators are focal points for provision of education to supplement irregular institutional engagements with the FBO/communities. We collaborated with a QES-AS scholar to facilitate participatory development of low-literacy financial literacy training materials (facilitator's manual and flipchart) with local institutions. The manual is completed, and the flipchart is advanced; training will take place under the QES-AS program in early 2023.

5.4.2 Dissemination meeting (100% achieved)

An end-of-project dissemination workshop was held on September 6, 2022. This was a multisectoral meeting attended by 45 participants representing 10 institutions and representatives from the intervention FBO. The purpose was to engage stakeholders on the progress, achievements and sustainability strategy of the project. Project PIs and staff presented information on the project's history, implementation and sustainability strategy. Participants had opportunity to engage with selected representatives from the intervention FBOs and the multisectoral sustainability committee members during two panel discussions. Some preliminary results were shared using the data placemats approach that allowed workshop participants to review the results and make their own interpretations before discussing the results as a group. The data placemats discussed at the workshop are provided in Appendix III.

6 Synthesis of research results and development outcomes:

In this section we synthesize our key research outcomes relative to our second specific objective (SO2): Test approaches that are transformative and that enhance both (a) the improved outcomes of women agripreneurs and (b) improved outcomes for the institutional stakeholders. The syntheses are presented as extended abstracts. References for the abstracts are presented in Appendix IV.

6.1 Results on outcomes of women agripreneurs and their household

6.1.1 Empowerment

Background. Ghanaian women experience inequalities in many areas of their lives that hinder their economic empowerment. Inequities exist, in part, due to cultural beliefs, social norms, systemic poverty as well as institutional biases. These factors limit women's access to land¹, diminish use of agricultural extension services², and influence the availability of loans through formal financial services³ thereby influencing their choices about crop farming and livestock raising as well as participating in value chains and profitable markets. Women of child-bearing age are affected more than men by health disparities. Buor⁴ and Saeed et al.⁵ linked living in rural areas and in poverty to higher morbidity and mortality. Rural Ghanaian women are at high risk of experiencing food insecurity, in part due to being less empowered to control their own resources and an inequitable intra-household distribution of food.^{6,7}

Methods. *Qualitative.* During the first three months of the *Linking Up* project, we conducted eight focus group discussions (FGD) with 54 women and seven FGD with 44 men who lived in six study communities and represented both FBO and non-FBO households to probe into local understandings of empowerment and women's empowerment. The qualitative research used the Constructivist Grounded Theory⁸ to collaboratively develop meanings. The translated and transcribed FGD were analyzed following an inductive approach (open, focused, and theoretical coding). The constant comparison technique was applied at the open stage of coding to identify similarities and differences in the data⁹. Focused coding identified the emerging categories and finally theoretical coding was used to identify the connections and integrate core categories that represented the overarching themes¹⁰.

Quantitative. This was a quasi-experimental study that provided an in-kind agricultural loan (for poultry egg or vegetable production) and nutrition and business education to women through their farmer-based organizations (FBO). The intervention group (INT) included women who were FBO members at baseline (n=166); the comparison group (COM) was selected from non-FBO members living in the same eight communities (n=164). A male adult family member (n=205) was also enrolled. Both women and men provided data for the baseline and endline surveys. The Project-level Women in Agriculture Empowerment Index (pro-WEAI) was used to assess empowerment and gender parity among women and men.¹¹

Empowerment was measured with multiple questions on 11 indicators: (1) autonomy in income, (2) self-efficacy, (3) attitudes about domestic violence, (4) control over the use of income, (5) participation in household agriculture decisions, (6) asset ownership, (7) mobility, (8) access to and decisions on financial services, (9) work balance, (10) group membership, and (11) membership in influential groups. A score for each of the 11 indicators and a summative score were calculated separately for all women and for all men; empowerment was categorized as "achieved" with scores of $\geq 80\%$. The household gender parity was assessed (achieved: women's \geq men's score) for the 205 households that had both a woman and a man participant. An analysis of baseline data has been published¹². Generalized linear mixed models (PROC GLIMMIX) were used to test the associations between empowerment and household gender parity with woman's FBO membership at baseline, study arm, adjusting for covariates and the random effects of clusters (i.e., community). The endline analysis included baseline values of the outcomes.

Results. *Qualitative.* The FGD participants considered that empowerment rests on one's capability to improve circumstances by setting and meeting goals. Achieving one's goals was a component of internal (e.g., self-efficacy) and external (e.g., access to resources, social support) factors. The local description of an empowered woman was someone who exhibits qualities that help her achieve goals, takes actions to achieve goals, and works with others to achieve her own goals or common goals. The focus of empowerment was not individual but relational in nature. Local understandings of women's empowerment were mostly related to women's relationships with others and their reproductive, productive, and community roles within their environment.

"A woman is not as strong as the man so she will hire labourers to clear the land. Maybe she is also not having money so if she is in a group, she will go and borrow money to buy chemicals and hire people to

spray and weed the farm. In order to do well in farming, a woman will have to join a group to borrow money [.....].”(Woman)

Quantitative. At baseline, the mean empowerment score and the percentage of empowered in the INT group were higher than the COM group (0.82 ± 0.13 vs 0.73 ± 0.16 ; $P < 0.001$ and 69.4% vs 41.5%; $p < 0.001$). The men of INT households had a higher baseline empowerment score than men of COM households (0.83 ± 0.13 vs 0.79 ± 0.14 ; $P = 0.03$). The baseline analysis included 316 women and 198 men (14 women and 7 men had incomplete data); 191 households had no missing data for both the woman and the man. In the adjusted model for all women at baseline, the odds of being empowered was 3.3 times higher for INT compared to COM participants (aOR= 3.25; 95% CI [1.97, 5.33]). Women’s FBO membership was not associated with empowerment of the men at baseline. Households of INT group were 2.8 times more likely to achieve gender parity compared to COM households (aOR= 2.82; 95% CI [1.39, 5.84]). Women’s FBO membership was positively associated with the individual indicators of women’s empowerment related to attitudes about domestic violence (aOR = 1.66, 95% CI [0.99, 2.76]), access to and decisions on financial services (aOR = 1.71, 95% CI [1.05, 2.76]), mobility (aOR = 1.98, 95% CI [1.18, 3.32]), group membership (aOR = 2.74, 95% CI [1.42, 5.26]), and membership in influential groups (aOR = 3.12, 95% CI [1.87, 5.21]). Women’s FBO participation was not associated with men’s individual empowerment indicators at baseline.

Among just the INT group, there was no difference in the percentages of empowered women and men at baseline or at endline (67% vs 73% at baseline and 72% vs 69% at endline, respectively; NS). However, among the COM group, a lower percentage of women were empowered than men at both time points (42% vs 62% at baseline and 55% vs 74% at endline, respectively; $p < 0.01$). In contrast to the baseline analysis, gender parity at endline was not significantly associated with study group (INT vs COM) in the logistic model adjusted for baseline value, covariates for the woman and men, and clusters.

In the model for all women at endline, adjusted for baseline women’s empowerment, demographic characteristics, study phase, and cluster (community), the odds of being empowered was 1.7 times higher for INT than the COM group (aOR= 1.74; 95% CI [1.02, 2.93]). The same model was run for all women at endline but using individual dimensions of empowerment rather than the summative empowerment variable. Only those dimensions that were significantly different in bivariate analysis were tested in logistic regression models. Receiving the intervention (INT group) was a predictor of empowerment for access to/decisions on credit (aOR= 3.43; 95% CI [1.95, 6.03]); membership in influential groups (aOR= 1.91; 95% CI [1.07, 3.40]); and mobility (aOR= 1.89; 95% CI [1.10, 3.24]). Similar tendencies were seen for asset ownership (aOR= 2.32; 95% CI [0.87, 6.20]; $p < 0.10$); self-efficacy (aOR= 0.41; 95% CI [0.15, 1.13]; $p < 0.10$); and group membership (aOR= 1.93; 95% CI [0.91, 4.09]; $p < 0.10$).

Receiving the intervention (INT group) did not predict men’s empowerment at endline after adjusting for baseline empowerment, demographic characteristics (education and age), study phase, and cluster (community). Only baseline empowerment was a predictor (aOR= 2.72; 95% CI [1.25, 5.91]).

Conclusions. Being a member of an FBO (the INT group) was associated with greater empowerment, as seen by different indicators. The baseline analysis showed higher crude empowerment scores for both women and men as well as higher likelihood of being empowered and having gender equity in the household among the INT (FBO group) vs the COM (non-FBO) group. The baseline analysis was cross-sectional and therefore does not show whether empowered women join FBOs or FBOs help women become empowered. However, the endline analysis suggests the latter. The analysis controlled for baseline empowerment and therefore reflects the difference in status (change) between baseline and endline, a 74% increase in the likelihood of being empowered over the time of the project for women in the INT (FBO) compared to the COM (non-FBO) group. Although this was a quasi-experimental design and not a

randomized controlled trial that tests causality, the results are suggestive of a role that the intervention played in empowering the women.

6.1.2 Food security

Background. Agricultural interventions may benefit nutrition by increasing the availability of food at the household or increasing income that allows households to purchase more diverse diets. Targeted, food-based examples of interventions that promoted orange-fleshed sweet potatoes and eggs have shown a clear link between agriculture and nutritional status.^{1,2} Broader interventions, for example those that incorporate microcredit for agriculture-based activities, may also benefit households as demonstrated in the ENAM project (an intensive integrated loan-nutrition and small business education project) which improved food security and children's diet quality and linear growth in Ghana.³

Methods. This was a quasi-experimental study that provided an in-kind agricultural loan (for poultry egg or vegetable production) and nutrition and business education to women through their farmer-based organizations (FBO). The intervention group (INT) included women who were FBO members at baseline (n=166); the comparison group (COM) was selected from non-FBO members living in the same eight communities (n=164). A male adult family member (n=205) was also enrolled. The study was conducted over two years, with the half of the households participating each year. Both women and men provided data for the baseline and endline surveys. Food security was assessed with the 15-item Latin American and Caribbean Food Security Scale⁴. Households were categorized into food secure, mildly food insecure, moderately food insecure, and severely food insecure, based on the number of affirmative answers to the 15 questions. Families without children were assessed with only eight of the questions related to the household. Finally, a binary variable was created for food secure and food insecure (combining mildly, moderately, and severely). Generalized linear mixed model (PROC GLIMMIX) was used to test the associations between food security and study arm (INT vs COM), adjusting for covariates and the random effects of clusters (i.e., community). The endline model included baseline values of the outcomes.

Results. At baseline, the women in the INT (FBO) group had a substantially worse household food security status than the women in the COM (non-FBO) group ($\chi^2=8.37$; $p=0.039$) [this includes only the sample of 330 households that have both baseline and endline]. Only one-third (36%) of the INT participants were food secure compared to almost half (47%) of the COM group who lived in the same communities. The distribution of severity of deprivation among only the households classified as food insecure was similar among the INT compared to the COM groups (23%, 38%, and 39% vs 32%, 25%, and 43% for severe, moderate, and mild food insecurity, respectively; N.S.).

Given the baseline differences, the endline analysis for predictors of food insecurity adjusted for baseline food insecurity status. The generalized linear mixed model (using GLIMMIX procedure) also included the cluster (community) and phase (1 & 2) to reflect the study design, woman's formal education (INT and COM groups differed at baseline; 30%, 39%, 31% vs. 32%, 27%, 41% for none, primary, secondary or higher; $p=0.048$), and variables that have been associated with food security in the literature (women's and men's age, men's education, and household wealth). Only the baseline status and study group were significantly associated with endline food security status. Being food insecure at baseline increased the risk of food insecurity at endline by almost three-fold (aOR=2.82; 95% CI [1.34, 5.92]). Being part of the INT group increased by two-fold the likelihood of being food insecure at endline compared to the COM group (aOR=2.122; 95% CI [1.01, 4.44]). However, women's endline empowerment was associated with reduced likelihood of food insecurity in a model including only women and adjusting cluster (community), phase (1 & 2) and women's education, age and household wealth (aOR=0.44; 95% CI [0.25, 0.78]).

The use of a dichotomous variable for food security (food insecure vs food secure) hid key information on change in status among our sample. A new four-category, change-in-status variable using the full range of food security categories (food secure, mild insecurity, moderate insecurity, severe insecurity) was developed to examine if the household improved (e.g., moved from severe to moderate food

insecurity), worsened (e.g., moved from mild to severe food insecurity), remained food secure, or remained food insecure between baseline and endline. The distribution of this variable reflected a different story from the dichotomous variable assessment ($\chi^2=10.27$; $p=0.016$). While almost half (46%) of the INT households improved in their food security status, only one-third (34%) of COM households did so. About the same percentage of households worsened over time (18% of INT and 16% of COM households) and remained at the same food insecure status (16% of INT and 14% of COM households). Those who remained food secure was less common among INT than COM households (21% vs 37%), in part reflecting the lower percentage of households that were food secure at baseline. Multinomial logistic regression models examined these changes, again accounting for baseline status, study group, women's empowerment at baseline and endline, women's and men's education, phase, wealth, and age of women and men. Community remained as the cluster variable. Being in the INT group was positively associated only with mild food insecurity (aOR=3.56; 95% CI [1.12, 11.36]) compared to the COM group; there was no difference by group for risk of moderate or severe food insecurity. Being empowered at endline was associated with a reduced likelihood of being moderately and severely food insecure (aOR=0.41; 95% CI [0.17, 0.96] and aOR=0.19, 95% CI [0.07, 0.51], respectively).

Conclusions. There was an association between food insecurity and study group as well as empowerment at baseline and endline. As this was a cross-sectional survey, it is not possible to know if food insecure households sought out FBO membership (which seems plausible) or if FBO membership was disadvantageous and contributed to food insecurity (which seems unlikely). By looking over time, we note that the families in the INT group (members of FBO) were more likely to change their status - moving into a less extreme condition. While the analysis of the dichotomous variable (food secure-food insecure) showed that COM households are more likely to be food secure, it failed to demonstrate that INT households were making progress in improving their situation. The extreme conditions of moderate and severe food insecurity were not associated with participating in the intervention but were negatively associated with empowered women. In summary, women in the INT group (FBO members) began the Linking Up program in a worse food security situation and were more likely to have improved and reached a mild food insecurity status over the time of the project.

6.1.3 Nutritional status (diet and anthropometry)

Anthropometry

Background. Ghana today is experiencing a rapid increase in overweight (OW) and obesity (OB) in both urban and rural settings. The 2014 Ghana Demographic and Health reported that 29% of women and 8% of men in rural areas were either OW or OB¹. Analysis of national data sets between 1993 and 2008 demonstrated that the risk of being OW/OB was associated with age in a quadratic mode (compared to 15-24 y, 25-34 y had OR=3.3; 95%CI [2.5, 4.3] and 35-49 y had OR=2.2; 95%CI [1.7, 2.8]), higher education (compared to secondary and higher, primary had OR=0.4; 95%CI [0.2, 0.9] and none had OR=0.2; 95%CI [0.1, 0.4]), multi-parity (OR=0.7; 95%CI [0.6, 0.8]), and higher wealth (compared to the highest quintile, all other categories reduced likelihood, poorest had OR=0.26; 95%CI [0.2, 0.3]) among rural Ghanaian women.² The year of survey showed that the country has experienced a continual increase in risk (in comparison to 1993, all later years showed an increased risk; for example, 2008 had OR=2.2; 95%CI [1.7, 2.8]). Studies have demonstrated that there is a strong association between gender equity and health-related outcomes. A review of 13 studies³ focused on six sectors of health and development, including nutrition, and examined how nutrition outcomes were linked to constructs of gender inequality.⁴ Women's nutritional status was positively associated with freedom of movement, paid labour, control over her own income, and lower domestic violence. Thus, interventions that pay attention to empowerment and gender equity can be expected to support better nutritional status among women and their households.

Methods. *Quantitative.* This was a quasi-experimental study that provided an in-kind agricultural loan (for poultry egg or vegetable production) and nutrition and business education to women through their farmer-based organizations (FBO). The intervention group (INT) included women who were FBO members at

baseline (n=166); the comparison group (COM) was selected from non-FBO members living in the same eight communities (n=164). A male adult family member (n=205) was also enrolled. The study was conducted over two years, with the half of the households participating each year. Anthropometric measurements of women and men farmers were collected during the baseline and endline cross-sectional surveys. Different logistic regression models were used to assess variables associated with OW/OB (women only, men only, and households) and body mass index (BMI; women only, men only). Exposure variables that were tested included individual age, social support, mental health, self-efficacy, food security, and the other family member's OW/OB status, study group, and empowerment (overall and individual domains). Phase and community were included also.

Qualitative. Qualitative data were collected through six focus group discussions (FGDs) (three with women and three with men, aged 22-69 y and recruited from the COM group during phase 2) in three of the eight project communities. A structured guide and a nine-image body figure instrument (ranging from underweight to severe obesity) that was validated in African Americans were used to assess body image for men and women⁵. The FGD recordings were translated and transcribed from Krobo to English. The analysis used an inductive thematic approach.

Results. *Quantitative for overweight/obesity.* Among 196 households that had all data available for both a participating woman and man (spouse, son, brother, or father), at baseline, at least one of the participants (the woman, the man, or both) was OW or OB in 56% of the households; both the woman and man were normal weight or underweight in the remaining 44% of the households (Table 1).

Table 1. Distribution of weight categories by sex at baseline¹ (%)

	Underweight	Normal weight	Overweight	Obese
Women	5	52	29	14
Men	14	70	15	1

¹Includes only households with data on both women and men

Table 2. Nutritional status of women and men at baseline, by wealth index status (%)

	Low wealth		Middle wealth		High wealth	
	Under/normal	OW/OB	Under/normal	OW/OB	Under/normal	OW/OB
Women (n=318)	19.2	14.8	22.0	11.0	15.7	17.3
Men (n=198)	27.8	3.5	28.8	3.5	27.3	9.1

Wealth index: tertiles for the first component of a Principal Components analysis of 18 household assets (improved water source, floor, wall materials, roof, toilet, cooking fuel, owns agricultural land, small livestock, non-mechanized farm equipment, mechanized farm equipment, owns house or building, electricity, motorcycle, bicycle, cellphone, radio, television, and refrigerator)

The distribution of weight categories by sex and wealth at baseline in the whole sample is shown in Table 2. Women were heavier than men (2-way interaction: $G^2=42.74$; $p<0.0001$). There was an overall difference in the distribution of OW/OB vs underweight/normal categories by wealth, in both sexes, with the highest rates in the high wealth category (2-way interaction: $G^2=10.68$; $p<0.01$). However, the difference in distribution of OW/OB and underweight/normal associated with sex was modified by wealth. The increase in the likelihood of being OW/OB that was associated with the highest tertile of wealth was greater among men than women (3-way interaction: $G^2=57.54$; $p<0.0001$).

The logistic regression analysis for the women at baseline with complete data and not pregnant found that the risk of OW/OB was associated with age, age², wealth, and symptoms of mental health. The quadratic relationship with age showed that women's risk peaked around 44 years and then declined. The risk of being OW/OB was 60% lower in the middle wealth category compared to high wealth (aOR=0.40; 95% CI [0.21, 0.74]); the difference between low and middle wealth categories did not reach significance. Finally, a one-unit increase in the Self-reported Questionnaire (SRQ-20) score was associated with a 6% decrease in the odds of being overweight/obese (aOR=0.94; 95% CI [0.90, 0.99]).

Predictors of OW/OB among the men with complete data were age, ethnicity, and wealth. The quadratic relationship with age showed that men's risk exponentially increased throughout life. The risk curves crossed and the odds for women became lower than men after 68 y. Being Krobo (local tribe) was associated with a decrease in risk by 73% of being obese (OR=0.27; 95% CI [0.08, 0.93]) compared to other tribes (Ewe, Aka). The risk of being OW/OB was about 70% lower in the low and middle wealth categories compared to high wealth (low had aOR=0.31; 95% CI [0.09, 1.00]; middle had aOR=0.28; 95% CI [0.09, 0.85]).

Wealth was the sole predictor of a household having an OW/OB member in the logistic model. In comparison to low wealth, high wealth households had a 2.6-fold higher likelihood of having a woman and/or man with OW/OB (aOR=2.55; 95% CI [1.00, 6.50]). Middle wealth households did not have an increase in risk.

Quantitative for body mass index. The bivariate analysis of baseline data showed that women's BMI was associated with study arm. Those women in the INT group had an average BMI about 2 points above that of COM group women at baseline, placing the INT group on average in the overweight category and the COM group on average in the normal weight category ($26.1 \pm 6.5 \text{ kg/m}^2$ vs. $24.7 \pm 5.9 \text{ kg/m}^2$, respectively; $p=0.04$). There was no bivariate study group difference in baseline BMI for the men (INT group: $23.1 \pm 6.9 \text{ kg/m}^2$ vs. COM group: $22.8 \pm 10.6 \text{ kg/m}^2$; NS).

However, the generalized linear mixed model for women's baseline BMI, which accounted for cluster as well as covariates (woman's empowerment, age, and education, household wealth, and phase) did not demonstrate any association with study group (NS). Women's BMI was also not associated with study group in a similar model at endline, with baseline BMI included alone (NS) as well as with other covariates (NS).

The men's BMI at baseline model was similar to that of women's, but included both women's and men's empowerment. Only phase was a significant predictor of men's BMI at baseline; phase 2 men were heavier with almost four BMI units more than phase 1 men ($b= 3.88$, 95% CI: 0.90, 6.86). Men's BMI was also not associated with study group ($p=0.22$) in a similar model at endline, with baseline BMI included. Only education was positively associated with endline BMI (compared to none, primary $b=2.78$, 95% CI: 0.96, 4.61; secondary $b=1.97$, 95% CI: 0.28, 3.65)

Qualitative. The FGD provided insight into the perceptions of community residents. As the FGD were held after the project was initiated, we included only COM participants to avoid being influenced by the education provided by the project itself. Important insights were obtained from these FGD. First, although the residents understood that there was a relationship between OW/OB and health issues such as stroke - the body size that was considered a problem was one of obesity, not overweight. Therefore, health practitioners have substantial work to do to demonstrate that lower BMIs associated with overweight (25 to 29.9 kg/m^2) should be of concern to the population. Second, residents recognized that extreme body size also could have a consequence for the household economic situation by decreasing income through a diminished ability to work and increasing medical expenses. A negative effect on household economics could lead to increased poverty, debt, loss of household assets, loss of educational opportunities for children, food insecurity, poor mental health, and family discord.

"They [obese] will not be able to walk to the farm and work so they will not get any food. When the person is big in body size, he is likely attacked by stroke." (Man)

"... It brings fight and quarrels because since they are not working to get money and there is no food in the house..." (Man)

However, third, residents believed that there would not be negative consequences if the individual had the financial means to hire workers and pay their medical costs. Thus, wealth worked as a modifier of nutritional status for these household outcomes.

"The family will not be happy with you because if you are in the village with them and you cannot do the work that all the members in the family are doing, but if you have money that you can also you to support them then there will be happiness but if not problem" (Woman)

Finally, large body sizes were also recognized as being culturally appealing - representing authority and well-being.

“We have been living in this community and the situation is not all that good, so when you see someone who is developing bigger gradually, we can say that person is free from problems” (Woman)

“When someone with a small body in size has money in a family, people don’t respect or regard her. If the two of you come to visit us and we welcome you, because of your body sizes [obese], someone will say, our authorities have come” (Woman)

Conclusions. Overweight and obesity are a serious health concern in rural Ghana. About half of the farming households in the Linking Up project had at least one participant who was OW or OB. There is a large sex inequity with about three times as many women as men having excessive weight. The project participants did not recognize OW as a health concern and discussed serious health considerations, such as stroke, only for the highest (OB) body sizes. The main concern for households was the negative impact that excess weight could have on one’s ability to work and contribute to the household income. However, if financial consequences could be avoided (the individual has money to pay for laborers, for example), residents did not consider excess weight to be a problem. Culturally, larger body sizes are considered to reflect a household that is doing well and a respected individual in the community.

Diet quality

Background. Improving diet diversity (DD), a dimension of diet quality, is an important intermediary outcome for agriculture-based interventions intended to benefit women’s nutrition. We assessed whether receiving the *Linking Up* project intervention package (repayable agricultural inputs loan and training for poultry eggs or local eggplant production) was associated with attaining adequate DD (consuming ≥ 5 food groups a day) among women farmers in selected districts in the Eastern Region.

Methodology. Women in selected farmer-based organizations (FBO) who received the *Linking Up* intervention (INT group) and women farmers in the same communities who did not receive the intervention (non-FBO members, comparison (COM group)) were interviewed at baseline (before intervention initiation) and endline (12 months after the intervention started) about their dietary intake in the past 24 hours using the 24-hour dietary recall method. Foods consumed were categorised according to the 10 food groups included in the Minimum Diet Diversity_Women indicator. Logistic regression was used to assess predictors of consuming adequate DD at endline.

Results: At both time points, the most commonly ($\geq 94\%$) consumed food groups were (i) grains and tubers, (ii) meat, poultry and fish, and (iii) other vegetables. Prevalence of consumption of the remaining food groups was less than 40% except for other vegetables and other fruits. At baseline, more COM group than INT group women consumed other fruits (81.5% vs. 65.1%; $P=0.005$) and tended to have higher mean DD score (5.2 ± 1.4 vs. 4.8 ± 1.5 ; $P=0.060$). About 67% and 71% consumed adequate DD at baseline and endline, respectively, and there were significant group differences. Mean endline DD was 5.2 ± 1.2 for both groups of women. Only adequate DD at baseline was significantly associated with adequate DD at endline (aOR=2.4; 95%CI [1.1, 5.2]).

Conclusion: Although most women apparently consumed adequate DD at both timepoints, consumption was skewed towards three main food groups. The intervention was not independently associated with adequate DD at endline

6.2 Results on Outcomes of Institutional Stakeholders

6.2.1 Perceptions of impacts of capacity strengthening activities

Background. Rural women need capacity support from multiple institutions to overcome the multidimensionality of food insecurity and nutrition challenges. However, local institutions traditionally work in silos and have limited opportunities to synergize their activities while serving the same communities. The *Linking Up* project implemented capacity strengthening activities with local institutions

to facilitate multisectoral collaborations to provide holistic services to women farmers. The focus was to effectively engage in an integrated intervention to enhance livelihoods, nutrition and general wellbeing of women farmers and their households in selected on district and two municipalities in the Eastern Region of Ghana. We assessed institutional stakeholders' perceptions of how these capacity strengthening activities impacted their respective institutions.

Methodology. The project implemented a cross-sectional survey with personnel of five local institutions (District Agriculture Department, Ghana Health Service, Ghana Education Service, District Assembly and a local NGO) who were nominated by their respective institutions to serve on sustainability committees. These committees were established to oversee activities to sustain the *Linking Up* community interventions in the three districts. Using a 1-10 scale, the participants were asked to rate their perceptions of how much a series of institutional-based (n=4), community-based (n=4) and IT-based (n=2) capacity building activities were beneficial to their institution overall, contributed to new knowledge or improved services. Additionally, they rated their overall satisfaction with the *Linking Up* collaboration. Open-ended questions were used to obtain specific examples of impacts observed and opinions about the sustainability approach adopted.

Results: Sixty percent of the participants were male and the majority (73.3%) were in managerial positions; the remainder were directors (13.3%) and extension workers (13.3%). Average ratings ranged from about 5 to 8 or 9 across all institutions for contribution of the levels of capacity strengthening activities to new knowledge and improved services. Scores ranged from 6 to 10 for overall satisfaction with the *Linking Up* collaboration. The IT-based capacity strengthening was salient among specific examples of impact of capacity strengthening activities given. A representative from Ghana Health Service indicated awareness of obesity from the project activities: '*The research Linking Up shared with us on obesity was eye opening. It has led us to increase our messages on obesity prevention in the communities*'. There were concerns expressed about the sustainability strategy related to low commitment from sustainability committee members and lack of funding to support field activities.

Conclusion: Institutional personnel generally gave high rankings on the overall benefit and contribution of the *Linking Up* project's institutional capacity strengthening activities to new knowledge and improved services and articulated specific examples. Their expressed concerns about the sustainability approach were related to the institutions' own capabilities for continuity despite the capacity strengthening received through the project.

6.2.2 Summary of *Linking Up* achievements with collective impact approach

Background: Underlying the approaches tested in the *Linking Up* project was the *collective impact* approach, which is based on "the commitment of a group of important actors from different sectors to a common agenda for solving a specific social problem" (Kania et al 2011). From our perspective, rather than each institution working on its own, collaboration between different institutional stakeholders contributes to the desired impacts. The collective impact approach has five conditions that guided our initial study specifications: (1) sharing aspirations for developing a common agenda; (2) developing backbone organization(s)/network to facilitate the other conditions for impact; (3) engaging in mutually reinforcing activities; (4) engaging in continuous communication; and (5) developing shared measurement of processes and outcomes. These dimensions were to be tied to (i) improved, shared knowledge and skills of women and institutional staff as well as the three outcomes of interest, (ii) empowerment of women and institutional staff, (iii) success of women's business endeavors, and (iv) their households' nutrition.

Methods. As noted elsewhere in the report, we drew upon the multiple sources of qualitative data gathered over the course of the study to inform what we present regarding the collective impact approach we set out to use. These included participant observations, In-depth Interviews (IDIs) with officers of institutions that work with women and agripreneurs, and Focus Group Discussions (FGDs) with women in the Upper Manya Krobo District, and Lower Manya Krobo and Yilo Krobo Municipalities.

Results. We provide summaries regarding the five conditions for collective impact approach as experienced in the *Linking Up* project. First, the focus of *Linking Up* fed into a common agenda: to improve rural women’s income, nutrition and the effectiveness of institutions in the study district/municipalities. Second, in engaging the local institutions – District Agriculture Department (DAD); Ghana Health Service (GHS)/Municipal Health Directorate; Ghana Education Service (GES)/Education Directorate; District Assembly (DA); Business Advisory Centre (BAC); Local NGO and Rural Banks in the selected municipalities – in creating oversight committees, the intervention develop a “backbone network” to facilitate conditions for collective impact. Third, unified around the common agenda noted above, the various stakeholders in *Linking Up* engaged in mutually reinforcing activities. For example, the packages developed required coordination between the *Linking Up* team and the various institutions to ensure that women in participating FBOs received interventions that we report on elsewhere in this report. Fourth, for continuous communication we utilized a combination of in-person approaches, such as meetings and workshops, and virtual approaches, including Trials of Improved Practices (TIPS) for mobile messages and virtual platforms for institutional collaborations. The fifth condition for collective impact is the development of shared measures of processes and outcomes. A lack of implementation of shared measurement systems often blamed for failures in sustaining collective impact efforts (Stachowiak and Gase 2018). This condition is often the least developed, and that was the case for *Linking Up* as well. We made initial efforts, which were largely unsuccessful, to obtain comprehensive information about the key performance indicators that the various institutions use to assess progress at multiple levels: their individual staff (micro level), organizational sub-units (meso level), and the overall institution or sector (macro level). For example, in taking the individual staff level, as noted in findings about incentives, there were misalignments between the formal incentives for staff and what the latter indicated would motivate them to work in supporting women farmers. Further, we noted that while the project focused on the incentives in public local level institutions, further effort is needed to deepen understanding about the economic and other motivations that drive individual staff across government, business, and community sectors, at the local level, as well as at the regional, and national levels in Ghana.

7 Synthesis of Results Towards AFS Themes (5 pages max.):

7.1 Increasing agricultural productivity (Availability)

The *Linking Up* initiative focused on stimulating agricultural activities that were complementary to the usual agricultural practices of women farmers. It contributed to reducing the risk of food insecurity through i) diversification of agricultural production and ii) increasing off-season productivity. The household model of farming was applied. The project involved the male household members in supporting the women in poultry coop construction, land acquisitions for vegetable cultivation, and other farm activities. There is evidence of husbands supported their wives in their garden egg production activities.

The 132 households that focused on poultry egg production through in-kind loans of layers, experienced a large increase in a high-quality animal source food product that was available for consumption at household level and for sale in the local market. The poultry activity has greatly increased the availability of eggs in the project communities as well as communal marketplaces in the region. Over the two years of the project, women sold almost all of the eggs, over 1.8 M eggs primarily in the regional markets. A very small percentage of eggs were consumed in the home (0.5%, 9319) or lost (0.4%, 6572). In addition to eggs, the poultry provided manure that was used to enhance productivity of crops and contribute the sustainability of agriculture. The participants were trained on how to prepare compost from organic materials, including the fecal droppings of chicken. The project is promoting the use of this organic fertilizer over chemical fertilizers. The organic fertilizer is expected to improve soil health by increasing water-holding capacity and microbial activity.

Other women farmers focused on extending the time of harvest rather than introducing a new activity. By increasing the dry season land holdings of women through land rental, the vegetable intervention (garden eggs, the local eggplant) allowed 33 women farmers to take advantage of the community’s unique micro-

climate that supports year-round production. The intervention helped them to increase their productive capacity in the dry season to enhance availability of the vegetable at a time when it is relatively scarce from other areas. The women produced 76,321 Kg of garden eggs, 83% of which were sold (63,205 Kg) and 17% of which were consumed in the home or gifted (13,116 Kg). Production of garden eggs in the off-season ensured increased revenue with the early harvests as well as the sale of the produce at a period when supply was low. The initiative supported the women with improved seeds and pest management system to enhance productivity.

7.2 Improving access to resources, and/or markets and income (Accessibility)

Financial resources. The core component of the *Linking Up* project is a sustainable revolving credit system that provides women with repayable loans of agricultural inputs that are complemented with entrepreneurship skills (and other complementary) training by the staff of the permanent services available in the district. The project developed a strategy to institutionalization the revolving credit system into the local rural bank and the training support of women agripreneurs into the agricultural, health, education, and other district offices. There exists the capacity for scale-up beyond the initial beneficiaries and communities in these three districts; this scale up is presently taking place as the revolving fund begins to work with its third phase of women. This includes a collaborative effort at two stages. First, a district-level committee (made up of staff from district-level institutions including agriculture, health, education) identify new FBOs to support and work with the FBO women farmers to select agricultural businesses for a loan. Then, the district-level decision is reviewed by an oversight committee (Apex) made up of one institutional representative from each district, two bank representatives, one representative from civil society (a local non-governmental organization), and one representative from the University of Ghana's Nutrition Research and Training Centre (Asesewa). The Apex committee approves the loans and provides oversight. The institutionalization of a credit support system for women agripreneurs facilitates banking literacy among the women and helps remove constraints to accessing formal credit services on their own. The women in Phase 1 repaid 100% of their loans; 88% of the phase 2 loans have been repaid to date (with collection still on-going because of the challenges brought on by COVID). Good loan repayment performance by the women has resulted in the bank looking for opportunities to do business with the women and so improving opportunities for accessing formal credit for business activities.

Income. The agricultural livelihood diversification (in product as well as season of the year) that resulted from this initiative has enhanced women's incomes that can be used for further improvement of the diet, other household needs, or be a contribution to savings. Over the two years of the project, 132 women sold over 1.8 M poultry eggs with an approximate value of ~US\$180,000 (assuming an average of about US\$3 per crate), primarily in the regional markets. The 33 women who produced garden eggs, sold over 63,000 Kg at a value ~US\$124,000 (assuming a value of US\$2 per kilo) in the regional markets - obtaining good prices because of their ability to sell the crop when the supply in the market was low. The *Linking Up* project stimulated an increase in annual income of about US\$300,000 for 165 women, on average ~US\$1800/.

Through the project, the women have learned to work together as cooperatives for efficient marketing. Among the poultry farmers, groups of 3-5 women bulked their eggs together to sell to aggregators who either go directly to the communities for the eggs or meet with the women at a specified location to receive the eggs. This process continued during the COVID-19 restrictions, so the marketing of eggs was not adversely affected.

Access to district services. The project has contributed to energizing supportive supervision of the FBOs, particularly by the agriculture leadership and frontline agricultural staff. Women farmers have experienced more regular support from extension and veterinary services. Efforts to encourage non-agriculture institutions to deliver services to the women have led to representatives of these institutions (particularly Ghana Education Service and Ghana Health Service) to join training programs for FBOs with the women and provide information/education. The table below shows the total number of engagements (recorded in

visitors' books in the communities) and the percentage distribution of engagements by different institutions over the intervention periods. Institutional engagements were supplemented by regular monitoring visits by the project teams.

Percentage distribution of FBO Engagement Contacts by Intervention Phase and Institution

Institution	Poultry (period: 12 months)		Horticulture (period:4 months)	
	Phase 1 n (%)	Phase 2 n (%)	Phase 1 n (%)	Phase 2 n (%)
Total no. of engagement	97	104	10	11
UMKR Bank	50 (52)	62 (60)	6 (60)	3 (27)
DAD	32 (33)	21 (20)	3 (30)	8 (73)
GHS	2 (2)	6 (6)	0	0
Local government (BAC, Social welfare etc.)	3 (3)	5 (5)	1 (10)	0
GES	3 (3)	8 (8)	0	0
Others	7 (6)	5(4)	0	0

The women were invited by the Department of Food and Agriculture of UMKD and YKM to participate in their annual planning meeting. The meeting offered the women the opportunity to talk to crop scientists on perennial crop and poultry diseases such as *Newcastle's disease* and *fusarium wilt*, which affect their poultry birds and garden egg production. It is hoped that the disease challenges will be incorporated into their issues log for district-wide action.

The success of the project has encouraged other institutions to consider working with our communities. For example, KROBODAN, an NGO operating in Koforidua (capital of Eastern Region) has called on the horticulture group to learn about the women's activities and expressed interest in collaborating with the group on a new project to support *Landless Vegetable Crop Farmers*. They have started collecting initial assessment data for baseline assessment.

7.3 Improving Nutrition (Utilization)

Our preliminary surveys identified suboptimal diets (low diversity) and overweight/obesity as important issues among the women farmers. Auxiliary research activities through graduate students and a partnership with researchers from the Queen Elizabeth Scholars (QES) - Advanced Scholars program contributed to our understanding of the challenges to good nutrition and the need for capacity building at both the institutional level as well as in the communities. Our intervention packages support nutrition-sensitive activities through three key pathways: (i) home production (poultry and eggplant) that contributes to a more diversified household diet; (ii) increased income that, with nutrition education, contributes to the purchase of diverse, nutrient-rich foods in the marketplace, and (iii) women's empowerment which has been associated with improved food security.

While anecdotal reports from frontline staff suggested that there was an increased use of eggs in household meals in the communities, the egg production data suggest only a small percent of eggs remained in the home for consumption. However, the dietary intake data from three 24-hour dietary recalls at baseline and endline indicate quality moved in a positive direction for the FBO members (mean diversity score: baseline:4.8±1.5 vs. endline: 5.2±1.2; P=0.03)

Unfortunately, COVID-19 restrictions interrupted efforts to collaborate with the GHS to define opportunities and mechanisms to address nutrition gaps identified from the baseline survey with respect to dietary diversity and a high burden of overweight among the women. The mobile phone messaging TIPS was one potential avenue for reaching the women with behaviour change communication relative to

nutrition and other health topics. However, the very poor mobile phone network made this approach challenging.

Informing policy

The *Linking Up* project had sustainability as its core goal - the integration of the nutrition-sensitive intervention into the permanent activities of local institutions. We worked closely with district/municipal-level institutions in the planning, design, and implementation of the intervention packages to ensure that the activities will be mainstreamed into the regular programs of these institutions. The agriculture activities that were promoted were those demanded by the institutions and FBO themselves. All the local institutions signed a Memorandum of Understanding with the commitments for joint planning and execution of all agreed-upon activities. Each institution nominated a substantive focal person to serve on the project's coordinating committee that had oversight over the interventions.

The iterative process of planning the interventions with the stakeholder institutions has enabled reflection by the institutions on opportunities to create synergies with on-going programs (for example, the Modernizing Agriculture in Ghana programme).

The *Linking Up* initiative was participatory and dynamic to enable continuous learning and adaptation as our understanding of the context of both the local institutions and the communities they serve increased. Our continuous engagements led to mutual learning that directed both the project team and local institutions to explore new directions that could potentially influence policy and or strategies. The following list of activities suggests potential policy impacts and spillover impacts to individuals.

- ▯ One of the DoFA directors is adopting *Linking Up's* inputs loan concept to pilot a poultry intervention with five women in a new community using the institution's own funds. This is a deviation from their normal way of doing interventions on credit without expectation of recouping the investment and hence with limited opportunity for scale up and sustainability beyond initial recipients.
- ▯ Our rural bank partner has expressed interest in expanding its microfinance coverage to new communities as a result of the partnership with *Linking Up* and the loan repayment performance of the women.
- ▯ The National Board for Small Scale Industries' (NBSSI) district/municipality level Business Advisory Committee (BAC) through its engagement with *Linking Up* registered our women farmers to facilitate their application for governmental relief credit to mitigate the negative effects of COVID-19 on small and medium enterprises.
- ▯ The GHS in one of the districts indicated including the women's group on their community-level monitoring forms to prompt frontline staff to provide services to the women to be organized as a self-help group similar to the traditional mother-to-mother support groups for pregnant and lactating women. Non-pregnant, non-lactating older women are traditionally not covered by the institution's regular outreach services.
- ▯ The poultry intervention has attracted interest from individual community members and institutional staff. Two institutional personnel were motivated to initiate poultry enterprises of their own using the initiative's approach. Additionally, one of the intervention women's husband was inspired to start his own poultry enterprise.

- ▯ The FBO with the first cycle horticulture intervention having completed one season of garden egg production and successfully satisfying the payment of their loan repayment obligation in July 2020, planted an acre of onions on their group farm. Additionally, all the 14 women reinvested their capital into the vegetable farming business. They rented one-acre of land each and procured vegetable production inputs using savings accrued from the harvest of their garden eggs. The crops planted include garden eggs, cabbage, tomatoes and okra. Our field coordination team continued to provide technical support to the participants on crop health and financial management and maintained collection of production data on their second cropping.
- ▯ The project was invited to participate in the LMKM Department of Agriculture's Annual Planning meeting in July 2020. The purpose of this multi-stakeholder gathering of agriculturalists, researchers, and farmers was to brainstorm solutions for critical problems affecting farmers and agriculture in the municipality. The invitation to participate in such a meeting suggests an appreciation for the *Linking Up* initiative's approach and interventions.

8 Project Outputs

Project outputs include peer reviewed publications completed and published in Open Access Journals or in progress and Teaching Aids available upon request.

Peer Reviewed publications published or in review

- Aishat Abdu, Grace S Marquis, Esi K Colecraft, Naa D Dodoo, Franque Grimard, The Association of Women's Participation in Farmer-Based Organizations with Female and Male Empowerment and its Implication for Nutrition-Sensitive Agriculture Interventions in Rural Ghana, Current Developments in Nutrition, Volume 6, Issue 9, September 2022, nzac121, <https://doi.org/10.1093/cdn/nzac121>
- Esi K Colecraft, Grace S Marquis, Comfort M Pinto, Growing and Learning Together in Fostering Multisectoral Participation for Sustaining Interventions: Lessons from Three Successive Integrated Multidisciplinary Interventions in Rural Ghana, Current Developments in Nutrition, 2022;, nzac124, <https://doi.org/10.1093/cdn/nzac124>
- Abdu A, Marquis GS, Colecraft EK, Dodoo ND. Local meanings and perceptions of women's empowerment: qualitative evidence from female and male farmers in rural Ghana. African Journal of Food, Agriculture, Nutrition, and Development. (in review)

Publications at various stages of completion:

- Prevalence of overweight and obesity and associated sociodemographic factors among rural women members and non-members of farmer-based organizations [completed draft undergoing internal review]
- The role of household type (nuclear, extended and single parent) and household composition (mean number of adults, mean number of children and mean number of pensioners) on women's mental health outcomes in rural areas in the Eastern region Ghana [65% complete]
- Gender inequalities in service provision- myth or reality [75% complete].

Teaching Aids

- Gender Training Facilitation Guide (tested)

- Entrepreneurship Training Flipchart (untested)
- Facilitator Guide for Community Overweight and Obesity Education (untested)

9 Problems and challenges (1 page):

The project experienced several challenges over the course of implementation at three main levels; i) institutional stakeholder collaborations; ii) FBO/community processes; and iii) project management, some of which are summarized below.

Institutional-level stakeholder collaborations:

- We encountered some difficulties with our effort to nurture inter-institutional collaborations to foster institutions working in tandem in the provision of community services. The concept was particularly challenging for the institutions that typically do not interact with the project's target population. This was particularly true for 1) the Ghana Health Service whose services normally target younger women of reproductive age and young children and 2) the Ghana Education Service whose services target school children and adolescent girls. To address this challenge, we often discussed the necessity of multisectoral participation in addressing community nutrition and health issues during stakeholder engagements and provided the platform for different institutions to engage and identify their relevance to the work.
- Although our community interventions were designed to be integrated into the local institutions' routine operations, there were persistent requests for financial support to accomplish activities. This was due to inadequate institutional-level funding that hindered mobility for field work. Lack of institutional funding for even routine operations is a threat to sustainability. Our sustainability strategy includes charging a competitive interest rate on future loans to women with a portion of the funds going to support institutional activities that support loan recipients. A portion of the loan will be reinvested to grow the loan fund.

Community-level processes

- In our assessment of FBO selected for the interventions, we identified weak male-dominated leadership, poor record keeping and lack of group constitution/bylaws which could hinder successful intervention participation. This was addressed through group strengthening processes during the preparatory and monitoring capacity building process for the groups. Furthermore, the intervention recipients who were all female were treated as a smaller group within the bigger FBO group and received targeted training to build leadership skills among them.
- Government directives during the COVID-19 resulted in the FBO regular fortnightly meetings being curtailed which posed a major challenge as the meetings was main delivery channel for supportive services provided through *Linking Up*. This, plus irregular institutional engagements with the FBO prompted efforts (through the TIPS activities) to identify alternative means of communicating either through mobile phone-based voice messages or through peer education training.

Project management

- The global COVID-19 pandemic resulted in significant delays that affected timely achievement of various milestones (particularly the TIPS), some of which depended on research collaborations with scholars associated with the QES -Advanced Scholars program. The delays also affected the cost and progress of our interventions which necessitated the need for a no-cost extension, with limited funding.
- We were confronted with loss of project management staff and the closure of Heifer International's Ghana operations. The University of Ghana team hired a key Heifer staff member after the NGO closed to provide continuity to the project.

10 Overall Assessment and Recommendations :

The communication with our program officer was excellent throughout the project. It was useful to have periodic calls with her to establish expectations, discuss challenges, and obtain approval for necessary changes in the protocol and budget. We suggest that IDRC continue to encourage this open communication in the future, facilitating it with site visits for the program officer. Face-to-face meetings help develop human relationships and open communication.

The development projects that IDRC supports are addressing long-standing issues that require integrated approaches. This takes time. While we are quite proud of the progress we made during the *Linking Up* project, we recognize that the sustainability of the outcomes would be greatly improved with complementary activities that continue to strengthen the institutional collaborations over time. It would seem prudent, therefore, for IDRC to have a funding mechanism that supports second phase activities of promising projects. Grantees could submit 2nd phase funding requests to IDRC in the last 9-12 mo of their project so that there would not be a funding gap between the original project and the second phase. This mechanism would greatly enhance the progress of the exceptional projects carried out with IDRC support.