



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative

FEED THE FUTURE GHANA AGRICULTURE POLICY SUPPORT PROJECT (APSP)

SYSTEMATIC REVIEW OF FOOD SECURITY INTERVENTIONS IN
GHANA



Contract No. 641-C-14-00001



USAID
FROM THE AMERICAN PEOPLE

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SYSTEMATIC REVIEW OF FOOD SECURITY INTERVENTIONS IN GHANA (Oct 2016 – March 2017)

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ACRONYMS

ACDEP	Association of Church-Based Development
ACDI/VOCA	Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance
ADVANCE	Agricultural Development and Value Chain Enhancement
AEAs	Agriculture Extension Officers
AGRA	Alliance for Green Revolution in Africa
AFD	Agence Française De développement
APSP	Agricultural Policy Support Project
CIDA	Canadian International Development Agency
CSIR	Council for scientific and industrial research
CU	Concern Universal
FASDEP	Food and Agriculture Sector Development Policy
FTF	Feed the Future
GAP	Good Agriculture Practices
GCAP	Ghana Commercial Agriculture Project
GIZ	German Development Cooperation
GLSS	Ghana Living Standard Survey
IFPRI	International Food Policy Research Institute
INSTI	Institute for Scientific and Technological Information
IPA	Innovations for Poverty Action
IITA	International Institute of Tropical Agriculture
JICA	Japan International Cooperation Agency
MED	Monitoring and Evaluation Division
METSS	Monitoring Evaluation and Technical Support Services
MoFA	Ministry of Food and Agriculture
NGO	Non-Governmental Organization
NRGP	Northern Rural Growth Program
NSAICU	Northern Sector Agriculture Investment Coordination Unit
OBs	Outgrower Businesses
PCU	Programme Coordination Unit
PFTCDF	Presbyterian Farmer Training and Child Development Program
PPBD	Policy Planning and Budget Directorate
RING	Resiliency in Northern Ghana
SADA	Savannah Accelerated Development Authority
SARI	Savanna Agricultural Research Institute
SNV	Stichting Nederlandse Vrijwilligers (Netherlands Development Organization)
UG	University of Ghana
USAID	United States Agency for International Development
WAAPP	West African Agricultural Productivity Programme
WFP	World Food Programme
ZOI	Zone of Influence

EXECUTIVE SUMMARY

This report presents the findings of a systematic review of the impacts of agriculture-related food security interventions in Ghana (with special focus on the USAID Zone of Influence, ZOI) for the period 2006 to 2016. The ZOI covers northern districts of Ghana above latitude 8° N. This study was sponsored by the USAID-Ghana FtF Agriculture Policy Support Project (Grant No.: APSP-FAA-024). The study was originally aimed at quantifying the impacts of food security interventions in the zone of influence via systematic review and meta-analysis; identify the reasons for the choice of interventions and the impacts of the interventions on female- and male-headed households.

The study relied on secondary sources of information, mainly published research, project evaluation and other reports, predominantly from international development agencies, government ministries and agencies, and non-governmental organizations (NGOs). The documents were retrieved through physical visits to identified organizations and online searches of academic databases and institutional repositories or portals. In brief, the approach adopted included: (i) an explicit desktop search strategy to retrieve literature from scientific databases and grey literature sources; (ii) visits to identifiable organizations to collect available literature (such as reports) that is either unpublished or difficult to access; (ii) clear inclusion/exclusion criteria; and (iii) systematic coding and analysis of included studies. A protocol for systematic review, developed by the Campbell Collaboration, was adapted and used. The documents retrieved were systematically screened and coded for further analysis. However, the poor nature of data retrieved made meta-analysis unfeasible. As a result, this study relied on systematic review augmented with narrative review. To serve the purpose of the study, interventions were categorized based on five broad strategies (input supply, infrastructure, market access, extension and capacity building, and postharvest value addition/processing). The major pathways of the interventions to food security were increases in production volume or yield, increase in incomes, and reduction in lost harvest. Food security outcome measures related to quantity and quality of available food in the household, change in duration of the hunger period, and levels of food consumption and expenditure on food.

All the interventions in the included studies had a component on extension and capacity building (including training or education or promotion of technology, access to finance and provision of information). This suggests that access to quality extension services, training and finance is major intervention logic amongst the included studies. As a result, technology adoption rates were reported but food security outcomes were scarcely measured. This was a

defining characteristic of almost all the included studies as they focused more on process goals with little attention to outcome measures. Of all the included studies, 82% focused on increasing production as pathway to food security, 30% focused on postharvest value addition or storage, while 19% related to water and irrigation infrastructure and only 4% related to seed systems (with multiple intervention strategies and pathways). However, only 14% of the included studies measured change in crop yield or reported increase in average yield for beneficiaries. Greater adoption of technology and production were strongly related to longer duration of intervention. Results of the study show that huge number of interventions has been implemented in the ZOI between 2006 and 2016. However, difficulties with data/information sharing retard robust quantitative analysis of the impacts of these interventions on food security. Further, it seems that the monitoring and reporting styles of the development-oriented interventions are not consistent with systematic review and meta-analysis, making quantitative evaluation of pooled impacts difficult. Overall, due to the nature of information obtained, it was difficult to quantify impact of the interventions on food security. Based on individual analysis of documents, weak evidence for impacts on food security was found as food security outcomes were largely assumed (rather than measured) to occur through the identified pathways. Finally, a substantial number of the studies had no counterfactuals, weakening confidence in attributing impacts on food security for even the beneficiaries. Data gaps and inconsistencies in annual reports precluded analysis of impacts over time. It is concluded that evidence for impacts of the interventions in the included studies on food security is weak or largely assumed; and it is difficult to track impacts over time. A logical recommendation is the need for development partners to synchronise their measurement and indicators of food security outcomes. It is also recommended that some food security indicators are explicitly incorporated into intervention design while bearing in mind the potential need for counterfactuals. Open data or information policies should be given practical meaning in development-oriented interventions.

I CHAPTER ONE

I.1 Introduction

This study is part of the Agricultural Sector Policy Support (APSP) project sponsored by the USAID-Ghana. The study was aimed at assessing the overall impacts of interventions on food security in Ghana but principally in the USAID Zone of Influence (ZOI). This ZOI covers the area above Ghana's eighth parallel (latitude 8° N), comprising the three northern regions (Upper East, Upper West and Northern) and the seven northernmost districts of Brong Ahafo Region (Amanor-Boadu et al., 2013). Even though considerable progress has been made, food security remains a major challenge for both economic and agricultural development in Ghana. Food insecurity and poverty are prevalent in the ZOI. As a result, several agricultural- and non-agricultural-based interventions have been undertaken by the Government of Ghana, development partners and other non-governmental organizations (NGOs) to address the twin problems of poverty and food insecurity in the ZOI.

Generally, food security is said to exist “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (World Food Summit, 1996). The dimensions of food security are availability, accessibility and utilization of food, and the stability of these over time. The Ministry of Food and Agriculture (MoFA) defines food security as “good quality nutritious food, hygienically packaged and attractively presented, available in sufficient quantities all year round and located at the appropriate places at affordable prices” (MoFA, 2007). Improvement in food security and emergency preparedness are part of the core components of the agricultural development and poverty reduction strategy of the Government of Ghana as captured in the Food and Agriculture Sector Development Policy (FASDEP II).

Food security issues can differ from the household level to the national level with or without causal links. Thus, food security at national level is not necessarily an indicator of food security at lower levels such as district or household. At the household level, the major food security issues relate to disposable incomes, household food production, and food and non-food prices that impact on access to adequate quantities of the available food. Food insecurity is generally highest for the poorest households and individuals. In such circumstances, food insecurity is exhibited by hunger, longer duration of food unavailability, poor physical and economic access to food, and poor food entitlement, with the symptoms of malnutrition and under-nutrition. Food security in the ZOI is a major developmental challenge due to the prevalence and depth of poverty in this part of Ghana. The ZOI has the highest rates of stunting and wasting in Ghana (SRC Consulting Ltd, 2014). For farming or natural resource dependent communities or households, food insecurity is driven by low

agricultural productivity, low employment opportunities and incomes, seasonality, high cost of inputs, poor infrastructure and weak markets. Livelihoods in the ZOI are largely agriculture or natural resource dependent. Due to the multiple causes of food insecurity and the prevalence of agriculture-based livelihoods, agriculture-based interventions seem to be a major pathway to address food insecurity in the ZOI. As a result, this study focused largely on agriculture-related interventions.

This report presents the results of a systematic review of the impacts of agriculture-related interventions on food security in the USAID-Ghana ZOI. The data and other information used in the analysis were drawn largely from secondary sources, published research and other reports, mainly from international development agencies, government ministries and agencies, and other NGOs.

1.2 Motivation for Systematic Review and Meta-analysis

1.2.1 Systematic review

Food insecurity challenges are multi-faceted and so assessment of food security impacts of development interventions, as well as food security policy making, cannot depend on the result of a single study. Moreover, studies on food security consider different aspects of food security and span across different spatial and temporal scales. Consequently, whilst research data and methods that provide the information on food security are frequently scattered and diverse, assessments and findings have also been contextual and place specific (Coates et al., 2006; Misselhorn, 2005). Also, notwithstanding the efforts made in studies involving food security, the understanding of the causal structures and dynamics of country-specific food security issues remains patchy and anecdotal (Misselhorn, 2005).

Globally, data and methodology employed to gather information on food (in)security in a given locality is often reliant on statistical data (often gleaned from FAOSTAT: FAO Statistical Databases) showing national 'food balances' - national production, yield or harvested areas versus national kilocalorie requirements. The problem with this approach is that the statistical data itself is frequently unreliable due to the methods employed in gathering, manipulating and/or aggregating the data (Misselhorn, 2005). For example, the accuracy of data in the FAOSTAT databases will affect the accuracy of any ensuing estimate. For Ghana, the data fed to the FAOSTAT databases might be unreliable due to the country's poor data collection and aggregation on food production, import, and export. There can also be the issue of underreporting regarding the scale of production or consumption of some food items due to weak institutional frameworks in the country (Yawson et al., 2016). Until now, very few comparative studies (if any) have aimed to synthesize the disparate information on food security studies or interventions to inform policy on food security in Ghana.

Even in situations where some form of synthesis of food security data have been conducted, these have been carried out in the form of traditional narrative reviews.

Narrative reviews have, however, been found to be inadequate to address current needs for quantitative synthesis of research results to provide evidence for policy decisions or interventions. Indeed, narrative review offers expert interpretation and perspective, but it is inherently subjective and non-quantitative. Because narrative reviews have no strict criteria for selection of studies for the review or for judging study quality, it is normally characterized by low repeatability, and the results are usually inconsistent, inconclusive or conflicting. Narrative reviews also have low efficiency in handling a large number of studies and possess limited ability to deal with variation in study outcomes (Koricheva et al., 2013). To this end, a narrative review of multiple agricultural-based interventions will miss vital insights that can underpin policy decisions or intervention design.

Systematic reviews present a tool which can be used to provide a precise summary of a topic and have many advantages over narrative reviews. These types of reviews are conducted for several reasons, but one that runs through all applications is the aim of formally synthesizing the results of a number of independent case studies (van den Bergh and Button, 1997; Hough and Hall, 1994). Systematic review was thus found to be most appropriate to the overarching objective of the current study. Steps of preparation of a systematic review include: (i) defining the review question (ii) selection of evidence sources (studies); (iii) implementing a search strategy; (iv) appraising and synthesizing the evidence/ critical evaluation of studies for biases; (v) data collection; (vi) data analysis and presentation of results; (vii) interpretation of results and drawing conclusions; (viii) improving and updating reviews; and (x) dissemination of the findings. The overall aim of these steps is to limit bias and to ensure repeatability of the review process (Schlosser, 2006).

1.2.2 Meta-analysis

The overall goal of reviews or synthesis is to understand the results of an individual primary study in the context of all the other studies (Borenstein et al., 2009). Whilst systematic reviews follow laid down protocols to synthesize primary research on a given topic with the purpose of integrating the results, meta-analysis provides a powerful, informative, and unbiased set of tools for summarizing the results of studies on the same topic. Thus, systematic reviews may include a meta-analysis and the aim of the meta-analysis is fundamentally to summarize the results. Meta-analysis expresses the outcome of each study on a common scale called the “effect size” (Borenstein et al., 2009; Koricheva et al., 2013). The effect size is a value which reflects the magnitude or direction of the treatment or intervention effect (Borenstein et al., 2009; Koricheva et al., 2013). The effect size could therefore represent the impact of a food security intervention, such as the impact of provision of inputs (improved seeds, agro-chemicals etc.) on crop yield; or the impact of capacity building of

farmers through provision of extension services on farmers' income; or the impact of introducing alternative livelihoods to farming communities on accessibility to food; or the impact of new marketing channels on the price of farmers' produce and ultimately, on farmers' income.

In conducting meta-analysis, the effect size for each study is computed to assess the consistency of the effect across individual studies after which a summary or overall effect is computed (Borenstein et al., 2009; Koricheva et al., 2013). If consistent effect size is found across various studies on a given topic, the aim then is to estimate the effect size as accurately as possible and to report that it is robust across the kinds of studies included in the synthesis (Borenstein et al., 2009). In contrast, if effect size varies considerably from study to study, the aim of the synthesis then is to quantify the extent and reasons of the variance and consider the implications for the variation (Borenstein et al., 2009; Koricheva et al., 2013).

The implication of using meta-analysis to provide evidence for any policy decision is that policy decisions would be supported by data across many interventions or studies, rather than the results of a single study or intervention. Ideally, meta-analysis should be based on uniform quantitative indicators or normalized indicators based on diverse quantitative or semi-quantitative results which can be compared across the individual evaluations (Bodnár et al., 2011). Moreover, for primary studies to qualify for meta-analysis, it is usually required that certain information be reported in such studies. For example, such primary studies should normally report the mean (\bar{x}), sample size (n) and a measure of dispersion (standard error-SE, standard deviation- SD, 95% confidence interval- CI) as numerical or graphical data, or it should be possible to estimate these from reported data for both the treatment (intervention) and its counterfactuals (Koricheva et al., 2013). For the present systematic review of food security interventions in Ghana, most studies included presented data using many diverse quantitative and qualitative indicators. Most studies also lacked the mandatory information such as SDs or SEs and sample sizes and counterfactual data needed for meta-analysis. The present systematic review therefore did not use meta-analysis to draw to conclusions.

1.3 Aims and Objectives

The main objectives of this study are:

- i. To assess the levels and causes of food insecurity in households with similar characteristics.
- ii. To establish the causes of the food insecurity situations observed in male and female headed households.
- iii. To identify interventions applied and their impact over time.
- iv. To establish the reasons for the choice of interventions and how they were related to the causes of the problem.
- v. Make recommendations to inform food security policy framework in Ghana.

2 CHAPTER TWO

2.1 Review approach and Methodology

2.1.1 Introduction

Data on food security interventions collected in this study were qualitative, descriptive or quantitative in nature or a combination of these. The data were therefore suitable to the applications of systematic review, more closely to literature review than to statistical analysis. By using systematic review, the first step in the process was to conceptualize food security for the present study. The second step was the development of review objectives, followed by the identification of data sources. The fourth step was the development of clear inclusion and exclusion criteria, followed by development and finalization of an explicit literature search strategy. The sixth step was database and institution portals literature search and subsequently, exclusion and inclusion of literature. As indicated in Chapter One, the current study adopted the systematic review methodology and followed the required processes. The above processes allow for convincing demonstrations of the efficacy or effectiveness of an intervention (Schlosser, 2006). Schlosser (2006) again observed that this review approach does not only help in the determination of relevant previous knowledge, but it is also a powerful tool for documenting knowledge gaps in the literature, which should be useful in shaping future food security intervention agendas.

2.1.2 Approach and Methods

We adapted the protocol developed by the Campbell Collaboration, for a similar study by the Policy and Operations Evaluation Department of the Ministry of Foreign Affairs of the Netherlands (Bodnár et al., 2011). The findings of this review draw on both published and unpublished sources of studies or interventions aimed at addressing food insecurity especially in Northern Ghana. Key components of the approach adopted here include: (i) an explicit search strategy involving a desktop search to retrieve literature from scientific databases; (ii) visits to identifiable organizations to collect available literature (such as reports) that is either unpublished or difficult to access; (ii) clear inclusion/exclusion criteria; and (iii) systematic coding and analysis of included studies.

2.1.3 Data sources

The study begun with the creation of a tentative list of organizations considered as major partners in Ghana's agricultural sector and/or major donor agencies involved in food security interventions. The tentative list was informed to a large extent by the Ghana agriculture sector development partners' coverage map produced by the Monitoring, Evaluation and Technical Support Services in Ghana (METSS- <http://www.metss-ghana.k-state.edu/maps.html>). The list was meant to guide the desktop search and visits; it was not considered exhaustive, but rather to kick-start a snowballing approach of information retrieval.

Peer-reviewed scientific publications are concise and usually are good at attributing effects to treatments, hence, they were the first source of data considered. Key words search was employed. Search strategy involved the use of key words, probable titles, logical operators and filtering techniques. The string for searching key words in title and topic was: "Ghana AND food security" AND "impact" AND ("agricultur*" OR "production" OR "production value" OR "production costs" OR "markets" OR "trade" OR "prices" OR "safety net" OR "women" OR "gender" OR "environment" OR "finance" OR "value chain" OR "Intervention" OR "Livelihood"). Effort was also made to search for so-called 'grey literature' to identify evaluation reports available from development organizations and institutions websites, together with portals of donor governments. This was intended to reduce positive-result publication bias, and provide more complete information on project set-up, interventions and costs, compared to more concise journal articles. Sources searched on desktop included:

- i. Scientific databases such as Google Scholar, Web of Science, Science Direct, RefSeek, Bielefeld Academic Search Engine (BASE), CiteuLike, Education Resources Information Center (ERIC), Infomine— (scholarly internet resource collections), and Scopus.
- ii. Web portals and general internet search using different search engines and strategies. These included the Africa South of the Sahara Food Security Portal and Ebrary knowledge repository both hosted by the International Food Policy Research Institute (IFPRI), the essential electronic agriculture library (TEEAL), access to global online research in agriculture (AGORA), and online access to research in environment (OARE) led by the United Nations Environment Programme (UNEP).

Visits were subsequently made to various organizations and institutions (Appendix I - in a separate document). The visits were undertaken to access unpublished literature such as annual reports, evaluation reports, dissertations and thesis on food security in Northern Ghana. Organisations visited included development and non-governmental organizations such as GIZ, ACDI/VOCA ADVANCE, Concern Universal, AfDB, WFP, AFD, AGRA, IFPRI, CSIR-INSTI, USAID-METSS, JICA, CIDA, SNV, NRGF, USAID-RING, IPA, ACDEP and Presbyterian Agricultural Services-Tamale. Other places visited were MOFA-PPBD, PCU-MOFA, MOFA-MED, MOFA-WAAPP, GCAP, NSAICU-MOFA, Departments of Agriculture (Kintampo, Tamale, Savelugu), University of Ghana and CSIR-SARI. The number of studies and/or interventions found after the first key word search and visits, and after the first screening of title and abstract is presented per source in Table I.

Table 1: Number of studies found after the visits and initial key word search and after the first screening on title and abstract

Source of Record	Records Retrieved from Online	Records Retrieved from Visit to Organisation
ACDEP	-	2
ACDI VOCA	2	-
AfDB	2	-
AGRA	12	5
CIDA	54	4
Concern Universal	-	3
Conservation Alliance	-	7
CSIR-SARI	-	10
IFPRI	8	-
IPA	15	1
JICA	-	3
MOFA	-	5
NRGP	-	49
NSAICU	-	28
Other Organisations	39	-
University of Ghana	-	54
USAID / METSS	57	40
USAID RING	-	6
WFP	-	4
World Bank	5	-
Total	194	221

2.1.4 Inclusion/exclusion criteria and evaluation criteria

A document was included in the study if it fulfilled the following a priori eligibility criteria: (i) is an original study; (ii) reports on any one or more of the following outcomes: food security, food insecurity, food stability, food availability, food utilization and food accessibility, food security intervention, impact evaluation of food security intervention; and iii) presents data on household level food security. Our exclusion criteria were a) a study on food security not of relevance to Ghana or Northern Ghana, b) a study on food security outside the time period of this study, and c) literature that did not directly address the objectives of this study.

2.1.5 Quality of the document

Criteria related to the quality of the document to be included were developed. These criteria excluded many studies at this stage. Quality of retrieved documents was assessed using the process summarized in Figure 1. Based on quality, documents were categorized as (i) Good; (ii) Sufficient; or (iii) Insufficient. A document was classified as 'Good' if it was a full report and results were attributed to the intervention by a plausible counterfactual analysis (e.g.: clear description of intervention strategy; there is both a comparison of 'before-after' intervention and a comparison of 'with-without' intervention; there is clarity of the problem definition and research questions, etc.). A document was classified as 'Sufficient' if it was a full document, a project profile or summary with

some details of the intervention, preferably with objectives and some results but without counterfactual analysis. An 'Insufficient' document had vague description of intervention, no results, no comparison to counterfactuals, and no reliability of the information source. Documents classified as 'Good' or 'Sufficient' were kept for further screening based on content of the document, whereas documents classified as 'Insufficient' were rejected at this stage.

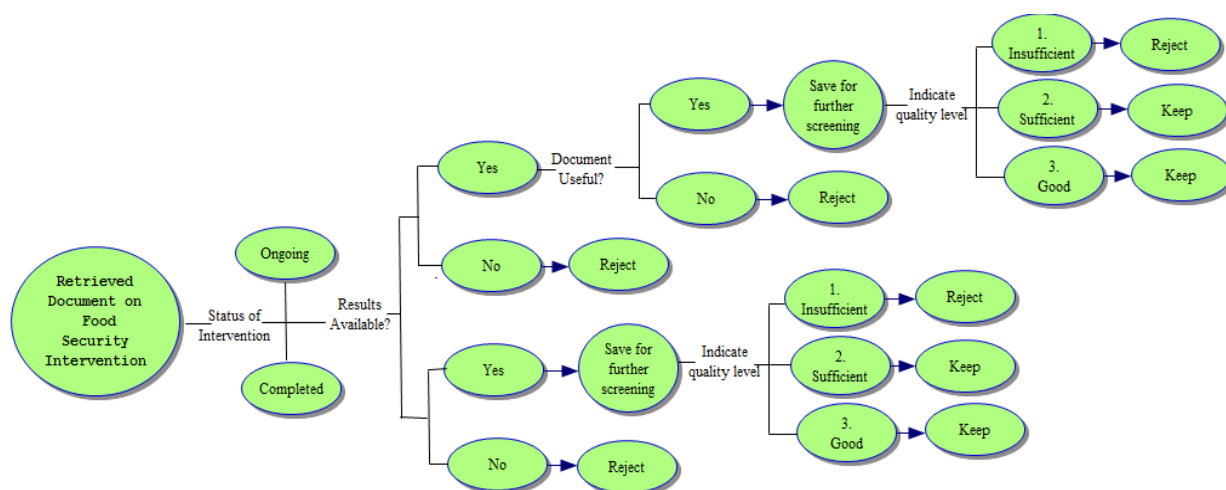


Figure 1: Flow chart for the criteria related to the quality of the document

2.1.6 Content of document

Criteria related to the evaluation of the content of retrieved documents were developed *a priori*. Food security is a very broad term encompassing many disciplines. For example, household food access is determined by the combination of household food production, household income, and household food stock, other assets and capital that may serve as a buffer in periods of food shortages (Bodnár et al., 2011). As a result, the scope of this study was limited to the analysis of five interventions strategies and their pathways to food security. In this context, the researchers were interested in studies that had disaggregated data based on gendered household headship. The five intervention strategies prioritized were related to:

- i. Inputs supply: interventions that support agricultural production directly, through provision of seeds, fertilizers, land, other agrochemicals etc.;
- ii. Infrastructure (water, irrigation, storage facilities etc.);
- iii. Value addition / Processing.
- iv. Market access: market, in this context, embodies interventions operationalized in both the input and output markets. We considered interventions that provided or enhanced markets

to farmers. Interventions that sought to make markets more efficient, to open up markets for consumers, or to protect domestic production;

- v. Extension and Training: interventions targeting the training of extension officers and/or farmers or delivering improved or targeted extension services; access to finance.

Obviously, these food security intervention strategies would have more than one outcome. The simplified constructed pathways and their respective outcomes considered in this study are presented in Figure 2. Some outcomes were specific for some intervention strategies but others transcend multiple strategies. For example, increased production volume could be attributed to changes in yield or harvested area. These outcomes could also arise from training and extension to farmers. An outcome such as improved storage may, however, be the result of post-harvest processing only.

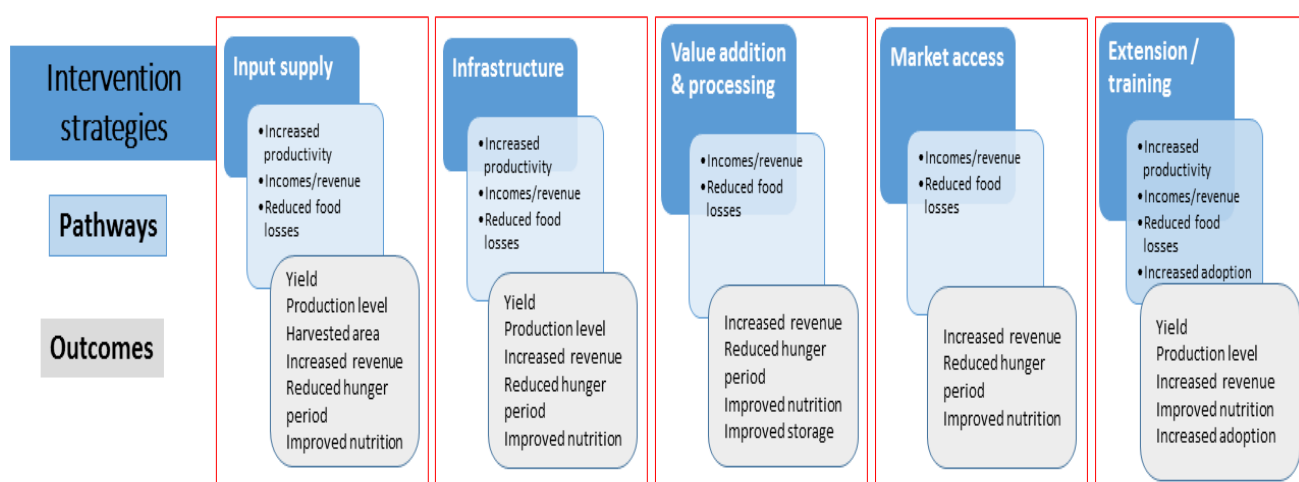


Figure 2: Intervention strategies, pathways and outcomes of food security used in this study

2.1.7 Coding of reports

Coding was done to capture the intervention strategies and outcomes in the retrieved studies. To better understand intervention characteristics, a coding sheet was used to extract the essential information from each selected document for further analysis. A document could also be rejected at this stage if upon careful scrutiny it lacked the relevant intervention strategies and outcomes. The number of studies during the subsequent search, screening and selection procedures is presented in Figure 3.

2.1.8 Analyses and presentation of included studies

In this study, meta-analysis was not used as originally intended because the studies evaluated either did not have the relevant data for meta-analysis or had many different quantitative and qualitative indicators, which were difficult to normalize. To address this shortcoming and to augment the analysis, summaries of some of the included studies, their claims or results were presented and

discussed. An overall description of the studies evaluated in the systematic review is provided in the following results section.

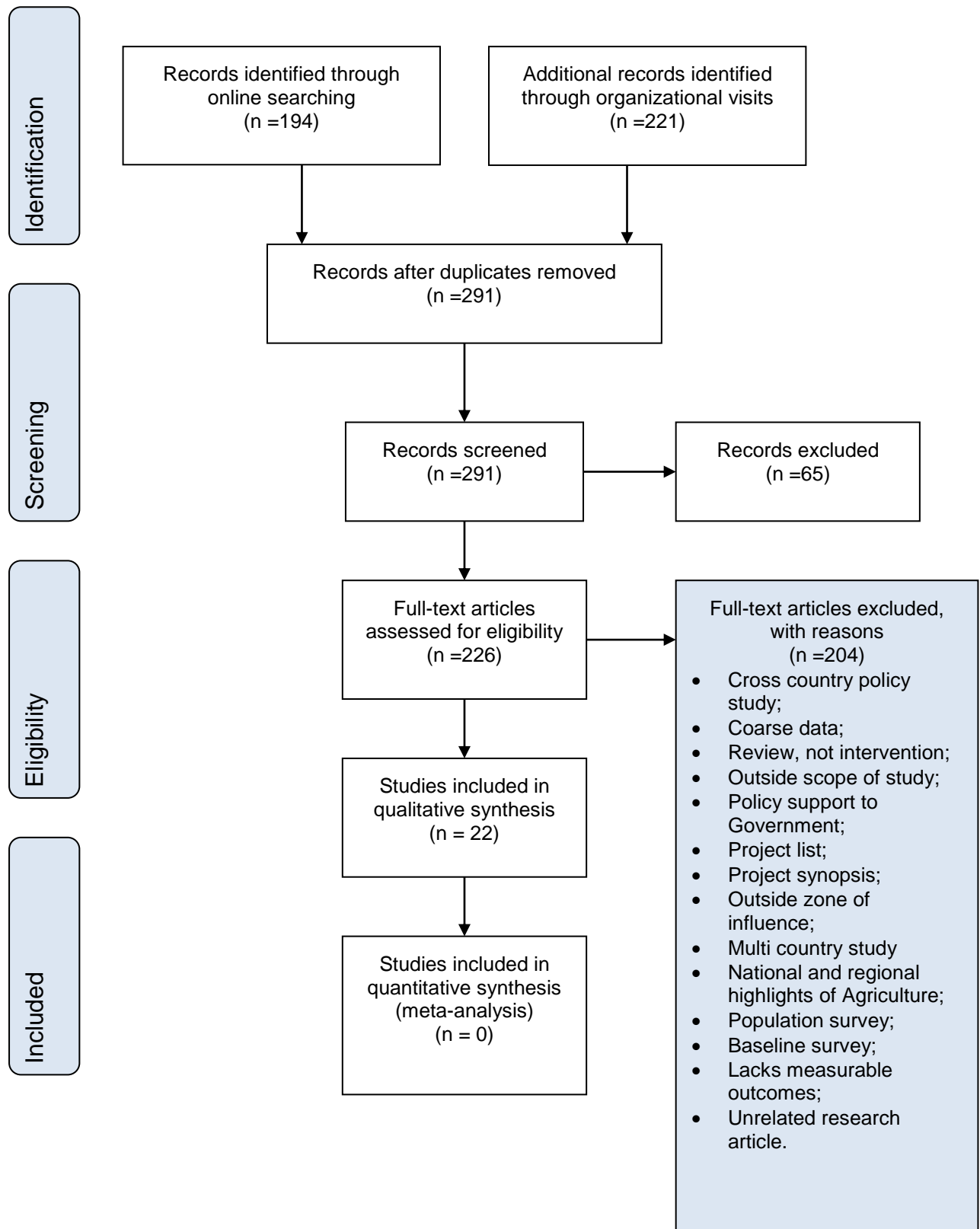


Figure 3: PRISMA flow diagram of review of studies on food security interventions in Ghana

3 CHAPTER THREE

3.1 Discussion of Results and Findings

Poverty and food insecurity remain a huge challenge across sub-Saharan Africa including Ghana. Despite decades of evolving approaches to alleviate food insecurity, it is persistent and widespread. In recent years, many of Ghana's development partners, particularly the USAID, have renewed their interests in and intensified their commitment to poverty reduction, food security and positive human health outcomes. Many studies of poverty trends and food security dynamics have focused on productivity, availability, and accessibility and welfare measures on their own. Few studies have compared household food security interventions and their outcomes systematically. This study offers a unique attempt to assess the net effect of food security interventions implemented by Ghana's development partners using data at the household level. The current study examined the extent to which interventions have led to reduced poverty, improved nutrition and food security at the household level. In response to the erstwhile Millennium Development Goal of reducing by half the proportion of people living on less than a dollar a day by 2015 and the more recent sustainable development goals, Ghana, together with its development partners, has formulated and implemented food security interventions. Success in reducing food insecurity in Ghana will, however, depend on accurate information as to the nature and causes of food security and on local and national policies based upon this evidence. This is a fundamental motivation for this study.

While significant advances have been made in methods for measuring food security and the efficacy of interventions, food insecurity is complex, multi-dimensional and manifests itself in myriad forms. Consequently, no single approach can capture all the essential aspects of food insecurity. Multiple methods combining quantitative and qualitative approaches are key to providing a deeper understanding of many of the processes underlying poverty, poverty transitions and effectiveness of food security interventions in Ghana and beyond (Adato, Carter and May 2006; Kanbur 2003; Lawson, McKay and Okidi 2006). However, there is need for a comparative analysis of existing studies on food security interventions, some of which measure similar outcomes of interventions using different approaches (e.g., using yield, production, health effects). Such comparisons are necessary to inform decisions about which methods are best for what purposes and under what conditions. Some studies indicate that interventions have culminated in positive outcomes whereas others dissent. Still, some studies indicate that food security interventions have led to no change at all either in the food security status or health outcomes of households. The picture is therefore unclear and the knowledge base on the efficacy of food security interventions remain fragmented. This makes it quite challenging to track and monitor the intended intervention outcomes. There is a need to accumulate evidence on the net effect of food security interventions in order to inform

decision-making and policy. This is essential particularly for developing countries such as Ghana, where financial resources are a major constraint.

3.1.1 Description of included studies

The following section shows the summary statistics on the studies evaluated. Of all the interventions reported in the included studies (Appendix II), 82% reported having supplied inputs (which comprised seeds, fertilizers, land, agro-chemicals) as a strategy (Table 2). However, for all studies that used input supply as intervention strategy, only 4% actually supplied seeds while 11% actually supplied two or more inputs (such as seeds and fertilizers). About 42% of the included studies focused on market access while 100% focused on extension and training or capacity building (Table 2). Thus, extension and capacity building featured in all the studies included. Approximately 30% reported postharvest value addition. Further, some studies undertook interventions related to infrastructure. Of these, 19% of the studies focused on water and irrigation facilities while 11% were on storage facilities (Table 2).

With regard to outcomes measured, 14% of the studies measured change in yield. All of these studies reported increase in yield (Table 2). Similarly, 41% of the studies reported increase in the level of production at farm or communal scale while 44% reported increase in revenues of intervention participants. Only 7% of the interventions measured increase in duration of food availability at household level (i.e. reduced hunger period) whereas 74% reported increase in adoption of technology from the extension, training and capacity building interventions. None of the studies measured meals eaten per day by intervention group or improved nutrition. The studies scarcely decomposed outcome measurement based on household head.

Non-parametric tests (Pearson chi-square statistic) were used to determine whether the observed differences in the zones of influence, duration of intervention, production level, yield, number of extension services rendered and specific food security indicators for any pair of measure were statistically significant. In instances, where they were significant the effect size was estimated using Cramer's V.

The intervention strategies considered in the studies examined were input supply, market access, provision of infrastructure (water and irrigation, and storage facilities), extension service and capacity building, and postharvest value addition and processing (Figure 2). The highest number of intervention strategies simultaneously considered by a single food security intervention project or study was 4, as shown in Table 3. Here, multiple interventions means two or more of the intervention strategies outlined earlier or indicated in Figure 2 had been applied simultaneously in a single project. About 17% of studies at the national level focused on only one intervention strategy,

whereas 67% and 16% of studies at the national level focused simultaneously on two and three intervention strategies, respectively. None of the national level studies focused on four intervention strategies simultaneously in a single study.

Table 2: Summary statistics on intervention strategies and outcomes. Main strategies are italicised.

Studies	n=27*	
Intervention strategy reported	Yes (%)	No (%)
<i>Input Supply</i>	81.5	18.5
Seed systems	4.1	95.9
Two or more inputs	11.2	88.8
<i>Market access</i>	42.3	57.7
<i>Extension training/capacity building</i>	100.0	0.0
<i>Post-harvest value addition</i>	29.6	70.4
<i>Infrastructure</i>		
Water and Irrigation	19.2	18.8
Storage facilities	11.4	88.6
Intervention outcome		
Changes in yield	13.9	87.1
Production level	41.3	58.7
Increase in revenue	44.2	45.8
Increase in technology adoption	73.9	26.1
Harvested area	0.0	0.0
Improved nutrition	0.0	0.0
Reduced hunger period	0.0	0.0

*Sample size (n) = 27 because some studies had provided information on multiple crops and these crops were coded independently for our analysis. Original number of included studies was 22.

Table 3: Number of intervention strategies considered by various food security intervention projects across Ghana based on studies evaluated

Region of intervention	Number of simultaneous intervention strategies targeted (%)				
	One	Two	Three	Four	
National	17	67	16	0	Pearson $\chi^2(15)$ = 33.2321; Pr = 0.004; Cramér's V = 0.7096
Northern	0	100	0	0	
Brong Ahafo & Volta	0	0	0	100	
Northern & Upper East	0	0	100	0	
Northern, Upper East & Upper West	14	0	86	0	
Northern & Brong Ahafo	0	50	50	0	

All studies in the Northern region focused simultaneously on two strategies (Table 3). Studies carried out jointly in the Brong Ahafo and Volta regions focused on four intervention strategies simultaneously in a single project. No study in the Northern region focused on more than two strategies in a single project at the same time. Similarly, no study focused on just a single intervention strategy in this region. The chi-squared statistic reported for the number of food security intervention strategies implemented both regionally and nationally based on the studies examined firmly rejects the hypothesis that region and number of food security intervention strategies are independent (Table 3). Cramer's V statistic of 0.71 is far greater than 0.3 indicating that the association between region where the intervention was implemented and the number of intervention strategies undertaken was very strong. There are disparities in the distribution of food security interventions or intervention strategies based on geographical locations. This is understandable given that poverty and inequality in Ghana vary systematically with geographical location in Ghana for which reason most development partners have zones of influence where their development interventions are focused.

The analysis also suggested that there is some association between how long an intervention lasted (i.e.: duration of the food security intervention) and the level of success of capacity building through provision of extension services (i.e.: results obtained following an extension training) (Table 4). The chi-squared statistic reported rejects the hypothesis that extension training is independent of the duration of the intervention. On the whole, adoption of technology introduced by extension services was higher for interventions that lasted longer. The effect size was also large based on the Cramer's V value.

Table 4: Association of number of extension training and duration of food security intervention

Outcome of extension training (%)	1-3 years	3-5 years	more than 5 years	
Increase in adoption	10	79	11	Pearson chi 2(2) = 9.3947 Pr = 0.009 Cramér's V = 0.6689
None observed	100	0	0	

Higher production levels were associated with interventions that lasted longer compared with those that were transient, as observed in Table 5. The association between the two variables was also very strong. However, there were no significant relationships between duration of food security intervention and yield (Pearson $\chi^2(2) = 1.3114$; Pr = 0.519), income of households (Pearson $\chi^2(2) = 1.0867$; Pr = 0.581) and duration of the year in which food was available in the household (Pearson $\chi^2(2) = 3.5133$; Pr = 0.173). Interventions that targeted productivity of agricultural households were strongly associated with higher yields (Pearson $\chi^2(1) = 13.1250$; Pr = 0.000).

Less than half of all studies evaluated had counterfactuals. Parametric tests (Pearson product moment correlation coefficient) were used to determine whether there were significant relationships between income prior to and after implementation of food security intervention, as well as the yield before and after intervention. There were strong relationships between income before and after implementation, and likewise between yield before and after implementation of food security intervention. Hence, low income households earn low incomes even after interventions, suggesting that currently food security interventions may be disproportionately benefitting those who are already outside the critical poverty level. Indeed, there are direct and strong links between interventions, prices and incomes, especially in shallow markets. In such markets, changes in yields or level of production due to agricultural interventions can substantially alter food prices, and thereby the revenues of net food sellers and disposable incomes of net food buyers. When food prices fall due to increased production, net food buyers gain and the reverse is true for net food sellers. This should be considered carefully by interventions that aim to increase production without connections to deep markets. Only two studies disaggregated the data based on gender of household heads. Owing to this, an analysis by gender of the dynamics of household food security could not be provided.

Table 5: Association of production level and duration of food security intervention

Production Level (%)	1-3 years	3-5 Years	more than 5 years	
Increase	12	88	0	Pearson χ^2 (2) = 7.1604, Pr = 0.028 Cramér's V = 0.7152
None observed	67	17	16	

3.1.2 Nature and causes of household food (in)security

A systems approach is adopted to explain the causes of food insecurity at the household level. The notion underpinning the systems approach is that the whole is greater than the sum of its parts. In this approach, any domain is viewed in terms of relationships and integration such that a food system encompasses all activities related to the production, distribution and consumption of food that affect human nutrition and health. In Figure 4, food (in)security status at the household level is determined by three interlinked set of factors—the food system environment, compositional attributes of the population and contextual factors.

There is substantial overlap and interlinkages among the components of the food system (e.g. biophysical, socio-economic and political environments). Food systems are further embedded in environments and societies (thus, both natural and social/political contexts) which differ according to a variety of factors such as agro-ecology, climate, social aspects, economics, health and policy as shown in Figure 4. There are two noteworthy defining characteristics of the food system. First, the

food system involves processes at multiple scales (agroecosystems, policy and technology development), which eventually have many impacts at the household scale, either in the livelihoods of food producers (who also consume food); and also for consumers. Second, food systems should be evaluated based on their capacity to ensure nutrition and health outcomes, and also the sustainability of natural resources and environments.

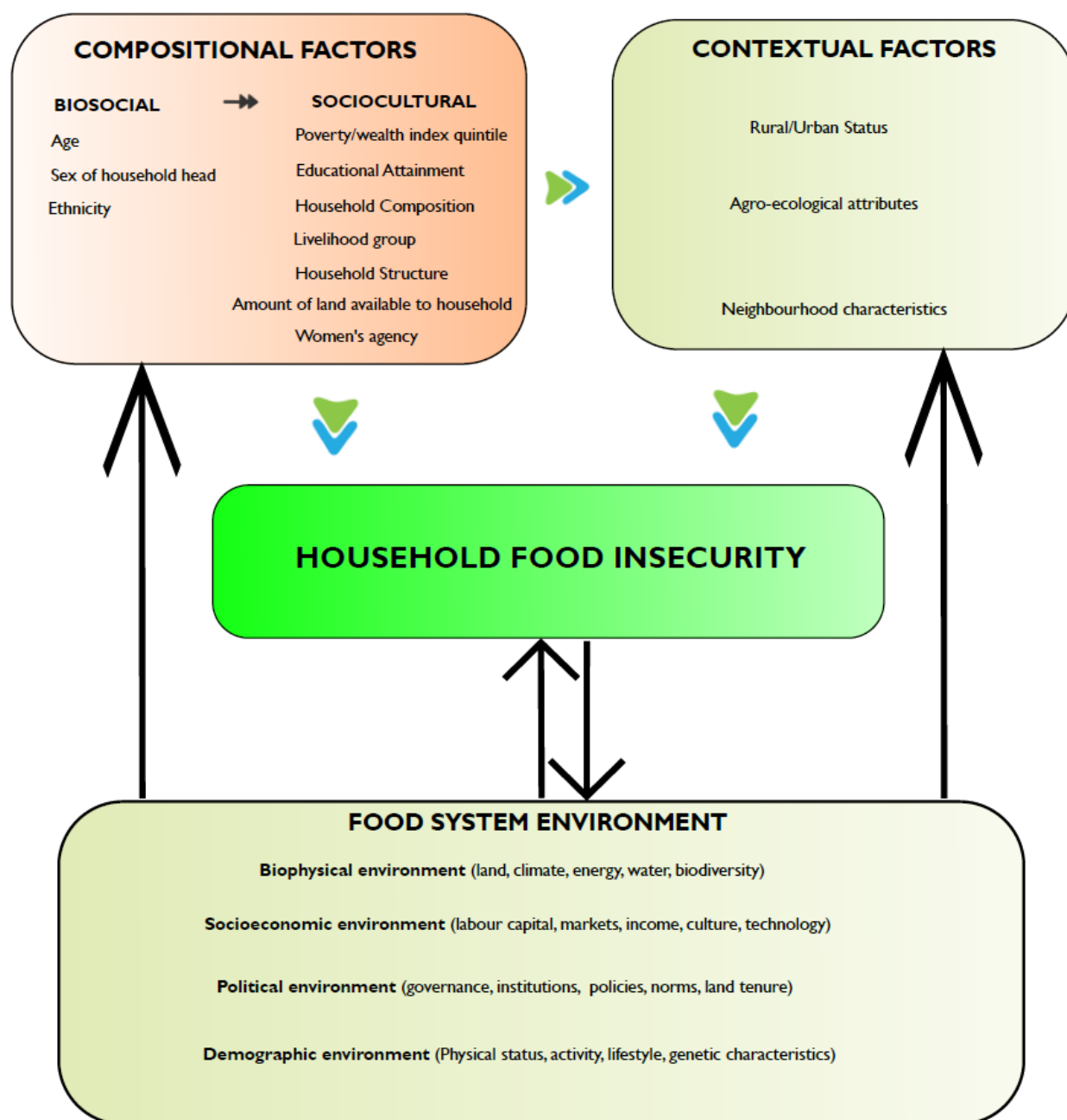


Figure 4: Synthesis of the causes of household food (in)security

Beyond the food system itself, compositional and contextual factors jointly influence the food (in)security status of households. Compositional (individual-level) factors can be divided into two categories: biosocial characteristics and sociocultural characteristics. Biosocial characteristics are those that have an underlying biological or physical component. As such, they tend to be “ascribed” characteristics present at birth and not easily amenable to change. Biosocial factors include age, sex, race and ethnicity, and with the exception of ethnicity all are rooted squarely in biology.

Ethnicity has its basis in a common cultural heritage, but endogenous marriage within ethnic groups often results in the development of a gene pool that fosters common physical characteristics. Biosocial characteristics have significant social connotations in that society ascribes certain social attributes to biosocial variables. For example, while being male or female is a biological condition, society attaches certain attributes to men (i.e., masculine traits) and to women (i.e., feminine traits). Appreciating and disaggregating these social attributes is critical to a nuanced understanding of the spatial heterogeneity and persistence of food (in)security in Ghana. Sociocultural factors reflect the position of society members within the social structure. Sociocultural factors, in Ghanaian society at least, are primarily “achieved” rather than ascribed. These are not traits one is born with in the biological sense, but those that are acquired (voluntarily or involuntarily) through one’s place in the social system. These factors are “cultural” in that those affected take on characteristics assigned by society. Sociocultural factors include marital status, income, education, occupation, and religion among others.

Although micro-level food security research initially focused largely on individual and household characteristics, recently, efforts are being made to explore the role of contextual factors in contributing to food security outcomes (Armah et al., 2011; CFSVA, 2012). Such efforts have variously examined the role of rural-urban disparities in access to food, neighbourhood characteristics, and varying agro-ecological contexts, generally focusing on one or another of these factors rather than using a more integrative approach that simultaneously considers multiple factors. To address this shortcoming, this study adopts an integrative/systems approach.

3.1.3 Differentiation of household food (in)security based on Gender

Due to poor availability of data on gender disaggregated food insecurity at household level in the included studies, a systems perspective on gender differentiation of household food (in)security is provided. Given similar opportunities and demographic profiles, female-headed households (FHHs) tend to perform worse than their counterparts, the male-headed households (MHHs). In particular, it has been shown that two households that are similar in every respect (except that one is headed by a woman and the other by a man) have different food security outcomes. For this reason, disaggregation of household food (in)security by gendered roles in agriculture and primary care

practices provides a nuanced understanding of marked disparities in wellbeing, nutritional status and health outcomes. In this context, there are many visible and invisible factors that emphasize women's vulnerability in agriculture which invariably contributes to food insecurity in their households. These factors encompass local social norms and traditions that cannot be captured in a statistical survey (Armah et al., 2011) and are intricately linked to division of labor, intra-household decision-making, and access to or control over natural resources and services (CFSVA, 2012). In some instances, MHHs have a 15-point advantage in food security compared with FHHs (Kassie, 2014). Even under counterfactual analysis, in which case MHHs are made similar to FHHs in terms of observed characteristics and resources, it has been observed that this lowers their food security indicating that hidden factors (differential advice from extension officers and credit services, managerial skill, family background) not considered in the literature pose serious obstacles to the food security challenge of FHHs (Kassie, 2014).

Women and agriculture are inseparable in Ghana given that they play a key role in agricultural production, food processing and marketing. They play a decisive role in dietary diversity and are responsible for nutrition in the home. In addition, women are involved in the production and domestication of plants and animals; they are knowledgeable in seed selection and vegetative propagation; they understand how plants and animals grow and reproduce; and they plant trees. While the roles of women in agriculture in Ghana vary widely by region, age, ethnicity and social status, their participation rates in the agricultural labor force is one of the highest in the sub-Saharan Africa. Owing to the fact that women tend to heavily rely on agriculture, a highly climate-sensitive sector, any stresses on the sector, including those related to climate change, are likely to have disparate impacts on their livelihoods. It is well documented that men and women also have different coping and adaptive capacities and consequently disparate vulnerabilities to the impacts of a changing climate (UNDP, 2010). This disparity has manifested in current experiences of extreme climatic events such as droughts and flood. One main reason for this disparity is the gender gap that restricts the access of women to land, financial services, social capital, as well as access to technology, which renders them vulnerable to food insecurity (FAO, 2011; World Bank, 2011). Men also play a crucial role in food production; however, they face fewer constraints than women. In most communities in Ghana, men are the heads of households. This position confers on them power in decision-making. Men are, thus, more likely to have access to productive resources such as land, credit and extension services. In cases of crop failure due to harsh climatic conditions, cultural traditions often make it easier for men to leave their farms in search of employment elsewhere, leaving women behind to struggle to feed their families and make ends meet. In many cases, women have diminished assets and resources to help them plan for and potentially avert the next crisis.

3.1.4 Evidence for food security is weak and impact is largely assumed

For households that depend directly on farming for food security, increased volume of production and productivity (higher yield per unit area) are good proxy indicators for household food security. However, increase in yield or production can also counter food security if it is not linked to markets or appropriate postharvest handling or value addition. In such a case, postharvest losses or lack of market can erode the economic base of the household and reduce motivation for increasing production in subsequent years. Similarly, increasing household incomes (through, for example, increased production, yield, and market access or livelihood diversification) can enhance food security through economic access to food (qualitatively and quantitatively). However, this improvement in food security will also depend on expenditure priorities and proportionate spending on different household needs. Hard measures of food security outcomes are needed to confidently attribute changes in household food security to particular interventions.

A substantial number of the included studies presented project achievements (process goals) as results and claimed having impacted food security (outcome goals), but the evidence is intuitive rather than verifiable. For example, The *Innovation for Rural Prosperity* project by CIDA (study code no. 50) based its claims of impacts on food security on the fact that farmers within the project target areas could access credits to purchase key inputs and access to trained extension personnel and quality extension services. While it is plausible that such conditions can improve household food security through increased yields or revenues, there is little evidence (if any) to indicate exactly how or what aspect of food security was improved and the scale of this improvement. This style of reporting, which was a defining characteristic of most of the included studies, seems to be the result of the monitoring systems, expectations or internal logic of development-oriented interventions, or the inadequacy of project design. However, this style of reporting is inadequate for pooled quantitative evaluation of impacts of the interventions on food security, especially at the household level. Summaries of some of the included studies, their claims or results and brief discussion or observations are presented below to illustrate the issues raised above. These case studies were selected based on the different aspects of intervention strategies and/or food security outcomes they cover, as well as the extent to which they illustrate the aforementioned issues.

1) **The ‘Food Security and Environment Facility’** project by CIDA (study code no. 46) targeted increasing farmers’ productivity and environmental management. The intervention strategy was capacity building via the provision of funding for local NGOs and private sector businesses to deliver a suite of agricultural innovations and technologies to farmers. Relevant technologies included (i) improved practices for the production of food crops such as maize, soybean, groundnut, mangoes and onions; (ii) drip irrigation and dry season farming, and (iii) improved crop storage. The study reported impressive results, including: (i) substantial increase in yields of maize and soybean; (ii) high

adoption of the innovations and technologies introduced (amounting to 45,045 beneficiaries, of which 25,710 were women); (iii) significant increases in farmers' incomes due to the ability to delay sales beyond the harvest; (iv) and a reduction in the annual "hunger period", during which daily meals are reduced due to food and income scarcity. These claims were presented in project highlights without full progress or evaluation report. Baseline conditions or variables were not reported and the margin of increase in yield was not reported. Hence, it is difficult to draw strong conclusions regarding impact on food security from this study.

2) **The Innovation for Rural Prosperity project by CIDA** (study code no. 50) delivered targeted investments in training and development of private sector enterprises providing smallholder-oriented products and services. As a result of this intervention, (i) a general marketing program regarding irrigation technologies for income opportunities, greater crop diversity and off-season production was delivered to 35,164 farmers (13,714 women and 21,450 men); (ii) 18,976 farmers (of which 10,016 were females) received agronomic extension and advisory support on nursery management, land preparation and transplanting of seedlings, effective irrigation, efficient water application mechanisms, crop disease and integrated pest management through a number of training sessions and field demonstration; and (iii) 3,038 farmers (1,871 women and 1,167 men) were able to access credit annually from some rural and micro finance institutions to buy irrigation facilities and related services, as well as inputs like seed, fertilizer and pest control. The pathways to food security from these intervention strategies are obvious, but the researchers were unable to assess the actual impact on food security given the nature of the available data. Similarly, proxy indicators of impact on food security of beneficiaries for this particular study could not be derived.

3) Among other capacity building strategies, the **Partnership for Enhancing Food and Economic Security for the Rural Poor** (study code no. 54) was aimed at increasing food security through raising agricultural productivity and supporting beneficiaries in the establishment and management of profitable income-generating activities. As a result of the intervention, an increased number of households have consulted extension agents for advice: 61% of households (headed by men) and 60% of households (headed by women) compared to a baseline value of 0%. Yield of main crop production increased from 310 kg per hectare to 510 kg for female-headed households. The formation of Farmer Based Organizations helped raise monthly income of beneficiaries from \$16.54 to \$62.83 for male-headed households and from \$10.72 to \$31.30 for female-headed households; and 44% of the households reported improved access to diversified financial assets from a baseline of 0%. This study reports baseline values for yields and incomes and therefore improves the confidence in the results, even though the absence of a counterfactual dilutes the strength of attribution.

4) The **MoFA-JICA Project for Sustainable Development of Rain-fed Lowland Rice Production** (Study code no. 106) was a well-planned and detailed rice extension strategy to boost rice production. The strategy involved the development of a technical package including land development techniques, appropriate rice cultivation techniques, and the deployment of farm management support systems and extension procedures. The project targeted raising rice yields to 3.0 ton/ha. Results of the MoFA-JICA Project for Sustainable Development of Rain-fed Lowland Rice Production project achieved average yields of 3.9 ton/ha and 3.1 ton/ha for trial plots and demonstration plots, respectively in the Northern Region. These were higher than the 2018 target yield of 3.5 ton/ha set by the Ghana National Rice Development Strategy. The project had 2,221 beneficiary farmers from 2009 to 2014 in nine districts. This was a very specific and direct experiment that achieved results that can have strong attribution of effect, but it is unclear as to whether it was a scientific experiment or a social intervention.

5) The main goal of the **Agricultural Development and Value Chain Enhancement (ADVANCE I) project** (study code no. 123) was to transform and increase the competitiveness of the maize, rice and soya value chains to *achieve a greater degree of food security* in the Northern, Upper East, Upper West, Ashanti, and Brong-Ahafo regions. The main strategy of the intervention was to improve value chain actors' access to market and finance while strengthening local production capacities, especially of women. Results (2014/15) showed that about 51% of women who attended the good agricultural practices (GAPs) trainings used improved seeds compared to 42.9% for those who did not attend; and average yield of women who used improved seeds was about 21% higher than those who did not. The implication (and for that matter pathway to food security) is that the GAPs training resulted in increased use of improved seeds which, in turn, resulted in increased yields. Further, while men always obtained higher yields across crops, marginal increases in yields of maize and soybean were higher for women than men. This is an intervention with an obvious pathway to food security and a good (proxy) indicator for food security (yield of food crops) and sensitive to women farmers. ADVANCE II (study code no. 159) had similar goals and built on the achievements of ADVANCE I. The ADVANCE II worked with 37,022 smallholder farmer beneficiaries via Outgrower Businesses (OBs) providing services on mechanization, inputs and output markets. Interim results suggested increased trading of maize, rice and soybean by farmers as a result of market facilitation by the project. Again, the pathways to food security (increased production and possibly incomes) can be deduced, but it would be great to measure some food security indicators at the household level, at least for some beneficiaries.

6). The overall goal of the **Northern Rural Growth Programme** (NRGP, study code nos. 135/136) by MoFA/IFAD/AfDB was to contribute to an equitable and sustainable poverty reduction and food security through sustainable increase in incomes for rural households in Northern Ghana. The

NRGP covers the three (3) northern regions (Upper East, Upper West and Northern) and five districts namely Kintampo North, Kintampo South, Pru Sene and Pru Districts in the Brong Ahafo Region. Progress reports of 2010 and 2011 (*study code nos. 135/136*) indicated high interest in the programme, with some of the programme components oversubscribed. Large areas were cultivated with maize and soybean. The programme reached a wide area and a large number of beneficiaries. For example, as of the end of 2010, the programme had enlisted 31,235 individual farmers (23,828 males and 7,426 females) to participate in the major season production. A total of 41,449 ha of various crops (83 % of maize, 13 % of soya and 4% of sorghum) were cultivated under the Commodity Chain Development component, while 2,028 farmers were able to access credit for the major season production. Similar impressive reach was reported in 2011. However, the outcome measures in the annual reports (2010 and 2011) do not show direct impacts on household food security even though the pathway is obvious. Hence, increase in area of production and access to credit was assumed to have a direct, positive impact on household food security.

The 2012 report (*study code no. 137*) indicated that the average yields of beneficiary farmers had increased by 150%, 160% and 58% for maize, soya and sorghum respectively. In absolute terms, maize yields had increased from 0.8 MT/ha to 2.2 MT/ha, soya increased from 0.5 MT/ha to 1.5 MT/ha whilst sorghum increased from 0.5MT/ha to 1.8MT/ha. The report indicated that farmers' incomes almost doubled due to increase in yields, reduction in post-harvest losses, and improved access to market. As of 2015, the report (*study code no. 137*) indicated that the total area of land cultivated was lower than that of 2010 but yield increases were higher in 2015. For example, average yields were approximately 3.5 MT/ha and 2.2 MT/ha for maize and soybean, respectively. Average yield of sorghum had reached 1.9 MT/ha. Due to the integrated approach adopted by the NRGP, it is plausible that the concurrent improvement in yields and production volumes, reduction in post-harvest losses, and access to market could improve food security in the target regions and districts. However, direct measurement of household food security impact would have enabled a more robust evaluation of the programme outcomes. Beneficiaries also dropped in and out over the years, making it difficult to attribute impact on beneficiaries over time.

3.1.5 Impacts on yield and income

3.1.5.1 Yields

Basic analysis of yield data in the studies that reported yields before and after interventions is shown in Table 6 for four main crops, namely, maize, rice, sorghum and soybean. For maize, yields before interventions (total of six studies) ranged from 0.31 to 3.38 Mt ha⁻¹, with a mean of 1.54 Mt ha⁻¹ and a standard deviation of 1.06. After the interventions, yields ranged from 0.51 to 3.69 Mt ha⁻¹, a mean of 2.15 Mt ha⁻¹ and a standard deviation of 1.24. Three studies reported on rice yields. Yields before

interventions ranged from 1.61 to 2.93 Mt ha⁻¹, with a mean of 2.11 Mt ha⁻¹ and a standard deviation of 0.72. Yields after interventions ranged from 2.93 to 4.0 Mt ha⁻¹, with a mean of 3.62 and a standard deviation of 0.60. Three studies reported on sorghum yields, which ranged from 0.50 to 1.08 Mt ha⁻¹ (before interventions) and 0.93 to 1.80 Mt ha⁻¹ (after interventions). For soybean, yields before interventions (total of five studies) ranged from 0.50 to 1.57 Mt ha⁻¹, with a mean of 1.05 Mt ha⁻¹ and standard deviation of 0.41. Yields after interventions ranged from 1.0 to 1.83 Mt ha⁻¹, with a mean of 1.44 Mt ha⁻¹ and a standard deviation of 0.31.

Table 6 : Descriptive statistics of yields before and after interventions

Statistic	Maize		Rice		Sorghum		Soybean	
	Before	After	Before	After	Before	After	Before	After
Minimum	0.31	0.51	1.61	2.93	0.50	0.93	0.50	1.0
Maximum	3.38	3.69	2.93	4.0	1.08	1.80	1.57	1.83
Mean	1.54	2.15	2.11	3.62	0.84	1.27	1.05	1.44
Standard Deviation	1.06	1.24	0.72	0.60	0.30	0.47	0.41	0.31
Skewness	1.09	-0.01	1.61	-1.71	-1.26	1.53	-0.10	-0.34

For the interventions that reported changes in yields before and after interventions, large increases in yields were reported (Figure 5). Rice had the largest percentage increase in yield (approximately 72%), while soybean had the smallest (approximately 37%).

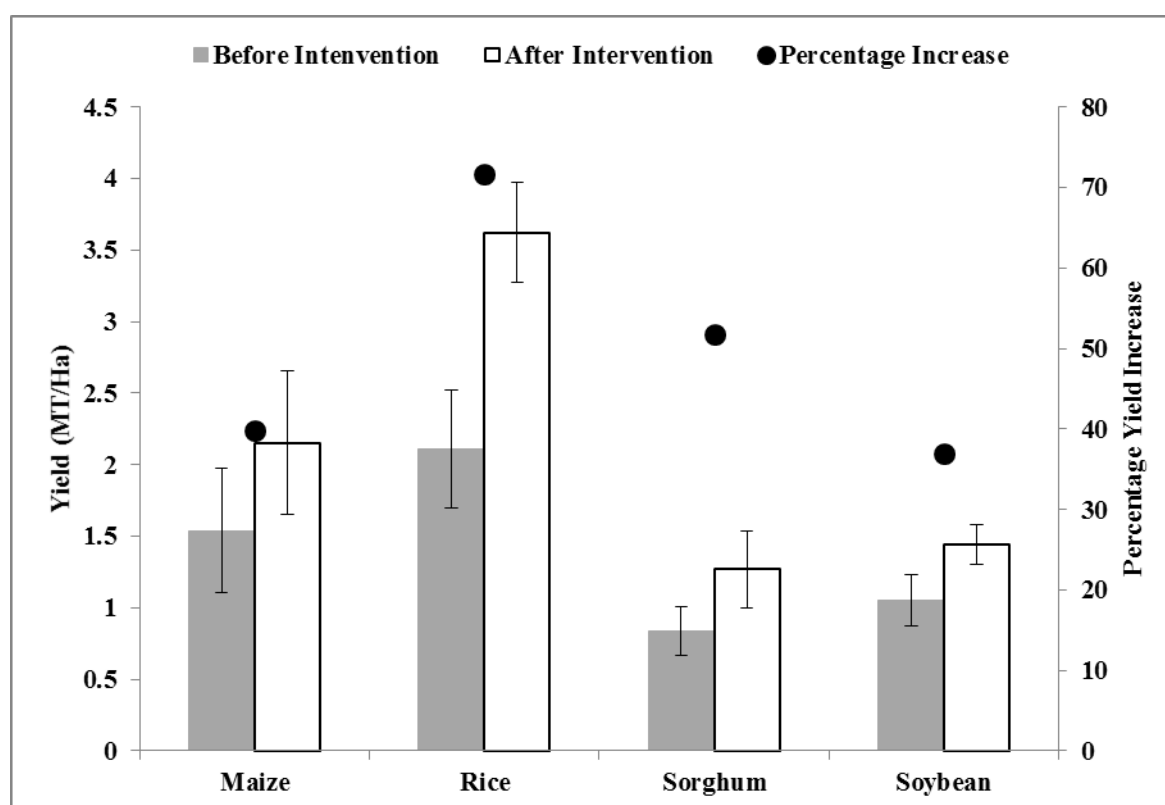


Figure 5: Mean crop yields before and after interventions

3.1.5.2 Income

Of the included studies, 44% (12 studies) reported on increases in income levels of intervention beneficiaries. Out of this number, seven studies provided actual numerical evidence of increases in income levels after a given intervention, whereas the remaining studies only indicated percentage increase in incomes without stating the base. Of those that reported good numerical information on increases in incomes, the unit of measurement was heterogeneous or inconsistent, making statistical analysis for similar crops difficult. For instance, some case studies reported increases in income levels of farmers after the intervention on a per hectare or acre basis (using prevailing market values rather than actual sales revenue), while others reported increases on a month or annual basis. Overall, six of the studies reported over 100% increases in incomes of beneficiary farmers. For example, on a per crop basis, average income levels of maize, rice and soybean farmers increased by 148% (from US\$ 283 to US\$ 701.9), 104% (from US\$ 254 to US\$ 519.25), and 119% (from US\$ 264 to US\$ 579.95) per ha, respectively. On average, increases in income levels of women were lower than those of men, with increases between 39% and 69% for women and 46% to 70% for men in maize- and rice-based interventions. This lower increase in incomes for women was attributed to lower yields and lower adoption of new technologies, and higher production cost compared to their male counterparts. Generally, the few studies that provided numerical evidence of changes in incomes show that the interventions, arguably, increased the revenues of beneficiary farmers. However, it is not clear from these studies if the observed increases were as a result of higher yields per unit area, larger production volume from expansion in cultivated land area, or sale of produce at a period of higher market prices or access to ready market with guaranteed prices. These are issues worth considering to guide future interventions and policy decisions.

3.1.6 Impact over time

Impact of interventions on food security can be observed within the duration of project lifespan or beyond. The current study relied on secondary information to assess the impact of interventions on food security. Tracking such impacts within a project lifespan requires *a priori* focus on food security indicators. Development-oriented interventions normally measure the impacts of a particular intervention within the project lifespan to determine differences between baseline and end-line indicators or treatment and control groups. As a result, intervention studies normally do not differentiate temporal patterns (in terms of sequencing, duration, or timing of intervention impacts among beneficiaries). Neglecting such vital information can substantially underestimate or even obscure the true scale of impacts of the intervention. Such was the observation made from the assessment of the studies included in the current review.

In the absence of baseline and temporal reports of real and homogenous data, it is nearly impossible to run a cogent commentary on the impact of an intervention over time. Perhaps one exception

worth mentioning is the MOFA/IFAD/AfDB's Northern Rural Growth Programme (NRGP). To their credit, NRGP provided a baseline report and all of their annual reports from 2009-2015. Even so, for some years the reporting style and content were not consistent with the ones of preceding years; hence, changes in specific data could not be followed over time. On other occasions too, crops had not yet been harvested and so some data were not available or ready at the time of compiling their report. However, some available data gleaned from the NRGP reports could exemplify how this particular intervention performed over time. From 2010 to 2012, for which these data were stated in its annual reports, the NRGP reported over 1200%, 600% and 50% increases in production, number of farmers and agricultural officers trained, respectively (Figure 6), demonstrating a positive impact of the intervention on these indicators. The concomitant increases in production, and number of trained farmers and officers suggests that training, both to Agricultural Extension Agents (AEAs) and farmers may be responsible for improved food production under the NRGP intervention (Figure 6). However, the substantial magnitude of increases reported require further scrutiny, which was not possible under the current study.

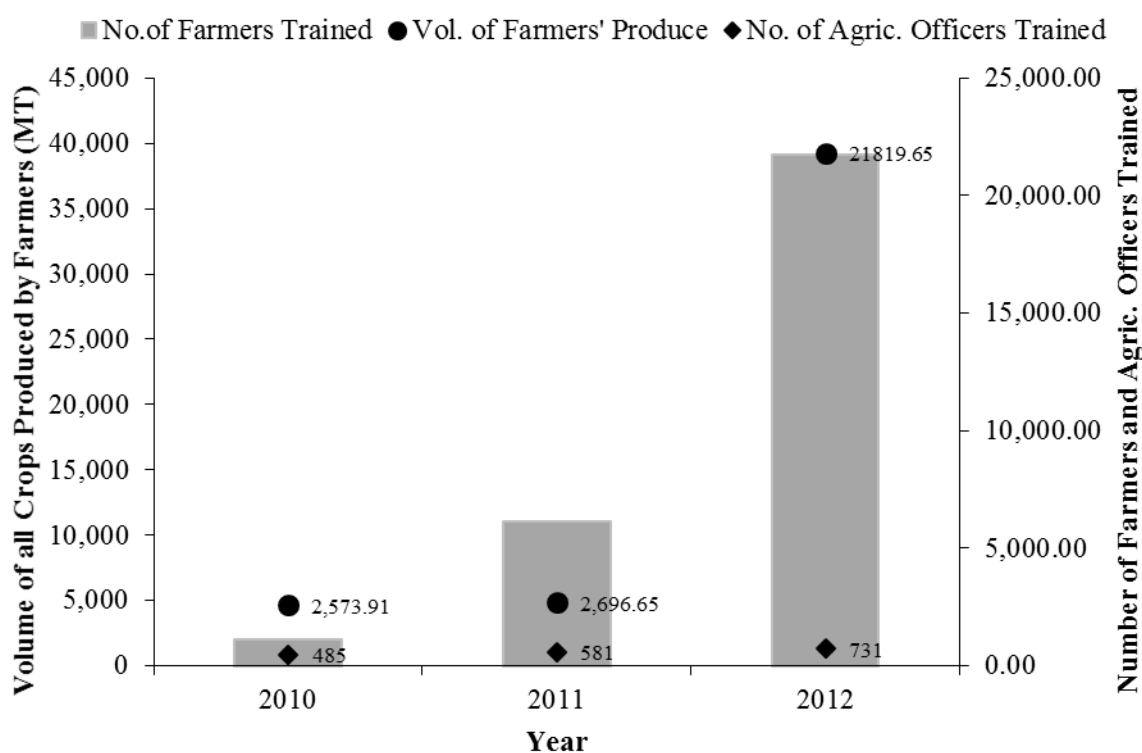


Figure 6: Cumulative production for all crops supported by the NRGP programme (Primary axis) and cumulative number of farmers trained by the programme from 2010 to 2012

3.1.7 The choice of food security interventions in Ghana and its relationship to the causes of the problem

Broadly, food security interventions have emanated from policy level commitments seeking to address the erstwhile millennium development goals and now the current sustainable development

goals. Most of the interventions are predicated on the recognition of the need to address systematic heterogeneities in food security and human health outcomes across the country. For instance, statistics from the Ghana Living Standard Survey (GLSS) indicate extensive disparities between the geographical north and south in terms of economic development and well-being, as well as urban-rural and gender disparities. There are therefore regional disparities in food insecurity due to seasonal food deficits in the three northern regions. A significant proportion of food-insecure Ghanaian households in rural as well as urban localities produce some of the food they consume. For most households, hunger is frequently associated with poor harvests resulting from poor or low inputs and technologies, environmental degradation, poor weather, natural disasters, or conflict. Almost all families supplement their food requirements with substantial amounts of purchased staple crops. Seasonal variability in food supply and prices due to climatic changes and other natural occurrences make it difficult for most households to meet their food demands year round, especially in the three northern regions. There is a fundamental motivation to bridge these disparities which are widening with time, to prevent the north-south inequalities from leading to tensions and instability.

Gender is also an important dimension of poverty, especially in northern Ghana where there is a sharp inequality between the income-earning opportunities of women and men. Addressing this disparity in a comprehensive manner requires agricultural growth and creation of processing and marketing opportunities for produce from the north. Some of the specific motivations are to develop inclusive and profitable commodity and food chains to generate agricultural surplus production and orient it towards remunerative markets in southern Ghana—through a commodity value chains approach. Providing relevant irrigation and market infrastructure, access to finance, and establishing viable producer organizations and their inter-professional bodies are key driving forces of the interventions.

4 CHAPTER FOUR

4.1 Challenges and Limitations to the Study

This study relied heavily on evaluation reports on interventions aimed at addressing food insecurity. Other documents included research articles that assessed similar interventions, project reports and communication materials. Substantial challenges were encountered with gathering information and/or data from key organizations. This in turn, created analytical challenges. Key challenges encountered are presented below.

4.1.1 Difficulties with setting up appointments

Initial data/information gathering encountered delays due to either bureaucracy or inactive contact information of the organizations concerned. Some priority organizations had contact information on their websites or on some other websites. However, the contact information (mainly phone numbers and email addresses) were either not active or incorrect. In some cases, the organizations simply failed to respond to our phone calls and emails for reasons internal to the organization. This situation created delays in setting up appointments with some priority organizations such as the Canadian International Development Agency (CIDA), Food and Agriculture Organization (FAO), and International Fund for Agricultural Development (IFAD). For CIDA, the relevant contact person was away for a long time, whereas constraints with FAO and IFAD were due to bureaucratic controls. These initial delays and inability to secure appointments with some priority organizations had a knock-on effect on visits to other organizations and the organizational coverage of the study.

4.1.2 Information sharing controls

Even though most development organizations and NGOs would claim to operate open data or information policies, the situation is not so in reality. It is true that several food security interventions have been undertaken by several organizations, especially in Northern Ghana. However, not all the information is shareable or accessible. As a result, physical visits to the organizations and Internet searches resulted largely in the retrieval of meta-information (summary, highlights, newsletters, policy briefs or other communication materials) rather than full evaluation, progress reports or datasets about the interventions due to internal information sharing controls. In other cases, it was not clear which partner organization had the authority to share the information. For example, the African Development Bank (AfDB) indicated that all the reports of the interventions they had been involved in were with the Ministry of Food and Agriculture (MoFA); so the project team was asked to either access the documents from MoFA or get clearance from MoFA to get the documents released. Attempts at both options failed. Due to time constraints, the project team was unable to continue going back and forth on some of these issues. Some organizations simply refused to share what they have. For some organizations, the contact person was new to the position and did not seem to have a complete overview of what was available or sharable. In other cases, the contact person was a project lead or referred the team to a project leader, resulting in

the sharing of information limited to the project(s) this person has been involved in. This creates information bias as the respondents might refer researchers to mainly projects that he/she is interested in or is familiar with.

4.1.3 Quality of documents shared/retrieved

As indicated earlier, information sharing controls resulted largely in the retrieval of meta-information about the interventions. Such documents were unsuitable for the inclusion criteria for the systematic review and meta-analysis. However, where evaluation reports were retrieved, there were quality issues with either the intervention design or evaluation. Often, the intervention designs did not have counterfactuals (intervention and non-intervention groups, or at least, baseline and end-of project information). In other cases, changes were reported in percentages without indicating the base. This situation makes it analytically difficult (if not impossible) to accurately quantify and draw strong conclusions on the overall effectiveness of the interventions. A good number of interventions are still ongoing, implying that full evaluation reports are unavailable. As a result, the project team had to make do with some progress reports if they satisfied minimum quality conditions. The consequence is that the number of included studies was lower than could be expected.

4.1.4 Heterogeneity and scale of interventions

Generally, systematic review and meta-analysis work best with homogenous studies. Unfortunately, the studies covered in the current review were heterogeneous (in terms of intervention logic and strategies, spatial and temporal scales) and most importantly, had different monitoring and reporting systems. This meant that even information collected at similar scales or on similar intervention groups were not comparable. More so, the information collected was fit for project reporting standards, but often unstandardized for research purposes. These issues posed critical methodological challenges.

4.1.5 Time limitation

The duration of this project was six months. Given the nature of constraints faced, more time was required to address them. Project-related administrative issues and bureaucratic constraints of organizations visited substantially delayed the project. It took much more time and effort than anticipated to get appointments and to get organizations to send documents they promised to share. Perhaps, if time was not limited, the project team could have combined intensive effort and patience to retrieve more documents relevant to the study. This could have been possible even with organizations that were initially uncooperative.

5 CHAPTER FIVE

5.1 Conclusions and Recommendations

5.1.1 Conclusions

Overall, impressive progress made at the national level on food security in Ghana is not reflected in the studies reviewed focusing on the zone of influence. In the period under review, despite the large number of interventions implemented in this geographical area, it is still difficult to quantify the progress made in bridging the disparities in food security. There is evidence of large scale food security interventions in northern Ghana. However, poor availability and limited access to relevant data constrained objective assessment of the impact of these interventions, spatially (across geographic units) and temporally (over time).

Even though 291 studies were screened, only 24 studies were included in this systematic review. The absence of an acceptable counterfactual analysis was the cause of the rejection of most of the excluded studies. With regard to intervention strategy, 82% of the included studies focused on production, half that number focused on market access. All of the included studies had extension and capacity building as part of the intervention strategy. Very few studies focused on water and irrigation facilities, storage facilities and seed systems. Of the total included studies, 14% measured change in yield, 44% reported increase in incomes of intervention beneficiaries and 74% reported increase in adoption of technology from the extension, training and capacity building interventions. For both yield and income, men out-performed women. Strong relationships were found between duration of intervention and increase in technology adoption or production level, with three to five years' duration having the greatest effect. Considering the low ratio of included to screened studies, general conclusions from the current study should be moderated with care.

The duration of the food security intervention, especially extension and capacity building, is important for rate of adoption of technology and production level. Although a vast number of studies chose increasing production as an intervention pathway, only few measured changes in yield, which is a key proxy indicator for food security. Also, the studies hardly decomposed food security outcomes based on the gender of the household head. Such interventions should endeavor to disaggregate data based on the gender of the household head. Given that most of the included studies had no counterfactual evidence, it was challenging to calculate the effect size and isolate outcomes that were solely attributable to the interventions. Consequently, interventions should measure changes in food security indicators selected at the beginning of the project to serve as basis for future evaluation. That means, interventions should focus not only on measuring process goals but also measuring some outcome goals which would be relevant for food security. For example, while increase in yield or revenue might be a good proxy indicator, measurement of actual

availability of or accessibility to food at the household would be a stronger indicator of impact on food security. This notwithstanding, increases in yields and/or incomes of farmers might positively affect food security beyond the household level. Finally, interventions that combine multiple strategies or pathways make direct attribution of impact to single pathways difficult, though the combined effect can be assessed. Such interventions can identify clear impact pathways and outcomes, with measurable indicators, for each pathway

5.1.2 Recommendations

- At policy level, it is recommended that food security indicators which are of interest to the Government and its various organizations, international and regional inter-governmental organizations, international and national civil society including private sector, NGOs and lobbies, and multinational firms, should be stipulated, a priori, to guide intervention design, implementation, monitoring and evaluation. This should potentially synchronise and harmonise the food security measures used in evaluation across interventions and eventually lead to better policy outcomes.
- Spatial (district or community) and temporal overlaps of interventions were observed. This observation indicates duplication of efforts and costs for organizations undertaking the interventions. It also indicates a practical or scientific constraint to robust analysis and the isolation of the impacts of different interventions on food security. It is recommended that MoFA work with organizations interested in undertaking interventions to minimize these overlaps. In addition, MoFA should develop capacity and interest to take over or sustain successful interventions after their lifespan. Ideally, MoFA should also guide development organizations to geographical areas where food insecurity is greatest, as well as share intervention frameworks and strategies which work best in specific areas.
- The occurrence of extension and capacity building in all interventions reviewed suggests a need for Government and development partners to agree to undertake a comprehensive assessment of how extension services and capacity building are impacting food production and value chain development, and ultimately develop structures to support and enhance extension service delivery.
- Given the ecological conditions and production characteristics in the ZOI, Government and development partners should come out with an intervention framework focusing on priority areas including water/ irrigation, climate change adaptation/ mitigation measures, food storage facilities or processing capacity, in addition to extension and capacity building.

Marketing is a major challenge in the ZOI but increasing production or yield without commensurate ready, reliable market or capacity to store the produce can be counterproductive or worsen poverty and food insecurity.

- Open data or information sharing/ dissemination principles should be integral component of food security interventions to ease access to data/information for objective assessment of impacts. The establishment of a one stop data/ information centre or repository by Government would be appropriate to facilitate compliance, reduction of doubling of efforts (through spatial-temporal overlaps of interventions) and value addition through wider use of data. The data/ information centre or repository should preferably be established at and managed by MoFA, and the centre should be mandated to streamline and set standards for reporting, collate, and store information/ data on all food security interventions undertaken by Government agencies, the private sector, NGOs and development partners.
- Food security interventions should consider the connections between aggregate food production in intervention area and markets. Where the markets are shallow, large increases in production can eventually reduce farmers' incomes due to fall in food prices.

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APPENDIX I:

This is a separate document detailing the organizations and institutions visited to retrieve documents and a signed-in-list of persons contacted during these visits.

APPENDIX II

Study code	Project or Report Title	Year of Report	Duration of Project	Organisation(s)
1	Expanding Climate Change Resilience in Northern Ghana (ECCRING) Project	2014	2012 - 2014	Canadian Hunger Foundation, CHF/ Association of Church Development Projects, ACDEP
3	Agricultural Development and Value Chain Enhancement Project (ADVANCE)	2015		USAID - ACDI/VOCA & ACDEP
46	Food Security and Environment Facility		2008-09-16 - 2016-11-30	CIDA
47	Food Security Through Cooperatives in Northern Ghana		2013-03-28 - 2018-03-29	CIDA
50	Innovation for Rural Prosperity		2012-07-31 - 2017-10-31	CIDA
54	Partnership for Enhancing Food and Economic Security for the Rural Poor		2011-05-06 - 2016-03-31	CIDA
56	Resilient and Sustainable Livelihoods Transformation in Northern Ghana		2012-08-29 - 2015-07-31	CIDA
63	Systems Approach to Improving and Sustaining Food Security in West Africa		2012-04-24 - 2017-08-30	CIDA
67	Transitional Support for the Food and Agriculture Sector Development Policy		2002-10-01 - 2012-05-29	CIDA
106	The project for sustainable development of rain-fed lowland rice production	2014	2009-2014	JICA/ MoFA
123	Reducing gender gaps in agriculture– a story from ADVANCE Ghana		2013 -2018	USAID
135	Annual Progress Report-2010	2011	2009 - 2016	NRGP - MOFA/IFAD/AfDB
136	Annual Progress Report-2011	2012	2009 - 2016	NRGP - MOFA/IFAD/AfDB
137	Annual Progress Report-2012	2013	2009 - 2016	NRGP - MOFA/IFAD/AfDB
145	USAID RING Annual Report 2015	2015	2014 – 2019	USAID
146	USAID RING Annual Report 2016	2016	2014 – 2019	USAID
158	FY14 Annual Report: FTF USAID Agriculture technology transfer project	2014	2011 -	USAID
159	FY2014 Annual Report (ADVANCE II)	2014		USAID
170	Do all roads lead to market: learning from AGRA's market Access programme Case study II: Ghana Arzakinmu "our wealth" programme	2013	2010 - 2012	Royal Netherlands Tropical Institute (KIT) and AGRA
177	Development of market access and postharvest services (DMAPS) for smallholder farmers in the Brong-Ahafo region. Pathways to Empowerment: Increasing Food Security for 50,000 Women	2014	2011-2014	AGRA/Concern Universal
182	Farmers	2016		CARE International
183	Pathways to Resilient Livelihoods	2016	2014 - 2016	CARE International

Reporting year and duration of project were not evident in some of the project reports