Monitoring adaptation to enhance food security: A survey of approaches and best practice

Working Paper No. 51

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Sabrina Chesterman and Polly Ericksen

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Abstract

As adaptation to climate change is a major theme for CCAFS, the programme needs a method for monitoring and evaluating interventions intended to foster adaptation and enhance adaptive capacity across food systems. This report explored current approaches to monitoring and evaluation of climate change adaptation projects and specifically how food security outcomes are being addressed. It emerged that monitoring and evaluation of adaptation projects is fairly new, and most documents outline frameworks rather than report on specific experiences. This was particularly true for food security per se, which was not an explicit focus of many of the adaptation projects that were assessed. This made it difficult to summarize best practice and to describe the most reliable indicators for assessing impacts of adaptation interventions on food security outcomes. Consequently, in line with recent discussions within CCAFS about the goals of using monitoring and evaluation to foster adaptive management and social learning the approach was shifted toward an outcome-oriented focus. This promotes active learning from monitoring and evaluation as the programme activities are implemented. The six key recommendations reflect these new discussions:

- Agree on a common framework or outcome pathway with clear and agreed outcomes. A common framework keeps all stakeholders focused on the desired outcomes, as well as the best approach to evaluating successful adaptation.
- Use scenarios to handle the necessary planning under uncertainty, combined with ex-ante assessments of adaptation investments and interventions to identify robust strategies.
- Engage in on-going monitoring using a clear "logic" model to track progress of the "robust strategies" on the ground. Ensure that the logic model is explicit about what constitutes successful adaptation for the outcome pathway.
- Take a learning approach to monitoring and evaluation with "stakeholders" at multiple institutional levels.
- Encourage data sharing across projects doing monitoring and evaluation of adaptation – there is a growing consensus around priority interventions and we have evidence about the success and impact of agriculture and food security interventions on key outcomes.

- Develop and use a tool for managing or evaluating impact given inevitable tradeoffs among food system outcomes.

Keywords

Adaptation; food security indicators

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Acronyms

ALM	Adaptation Logic Model
AMAT	Adaptation and Monitoring Assessment Tool
CCAFS	Climate Change, Agriculture and Food Security
CCAI	Climate Change Adaptation Interventions
CRP	Centre Research Program
GEF	Global Environment Facility
M&E	Monitoring and Evaluation
NAPAs	National Adaptation Programmes of Action
POW	Program of Work
PRC	Program Review Committee
PRSPs	Poverty Reduction Strategy Papers
RBM	Results Based Monitoring
UNFCCC	United Nations Framework Convention on Climate Change

Introduction

Purpose of the Report

As the CGIAR moves towards a greater emphasis on impact, every CGIAR Research Program (CRP) needs to develop tools for monitoring and evaluating progress towards outcomes and impacts. As adaptation to climate change is a major theme for CCAFS, the programme needs a method for monitoring and evaluating interventions intended to foster adaptation and enhance adaptive capacity across food systems. This report set out to:

- Review current approaches to monitoring and evaluation (M&E) in climate adaptation;
- Review current approaches to monitoring food security impacts of climate adaptation projects; and
- Outline a way forward including a recommended approach and gaps in knowledge.

Main findings

We had hoped to produce a report explaining how food security outcomes are being monitored and evaluated within climate change adaptation projects. However, we soon discovered two problems: 1) the monitoring and evaluating of adaptation projects is fairly new, and most documents outline frameworks rather than report on experiences; and 2) as we had feared, food security per se is not an explicit focus of many of the adaptation projects we searched. Thus it was quite difficult to summarize best practice and most reliable indicators for assessing impacts on food security.

Finally, recent discussions within CCAFS about the goals of using M&E to foster adaptive management and social learning have led us to re-think our approach. CCAFS is embarking on a much more outcome-oriented focus that includes learning from M&E as the programme activities are implemented. Our recommendations reflect these new discussions.

Key points

- Food systems are complex and dynamic, with interactions across multiple spatial, temporal and institutional scales and dimensions. However, partners implementing adaptation interventions need frameworks that they can work with now.

- The multiple outcomes from food systems, as well as different perspectives on what successful adaptation needs to achieve, means there will always be tradeoffs that cannot necessarily be resolved.
- Adaptation to climate change requires "transformational" or systemic change in many cases, but such change involves careful learning process, especially in order to avoid maladaptation.
- The long lead times and uncertainty around climate change make monitoring and evaluating adaptation more difficult than usual.

Recommendations to implement M&E for climate change adaptation in food systems

We propose six main recommendations for CCAFS (or similar programmes).

- Agree on a common framework or outcome pathway with clear and agreed outcomes. A common framework keeps all stakeholders focused on the desired outcomes, as well as the best approach to evaluating successful adaptation.
- Use scenarios to handle the necessary planning under uncertainty, combined with ex-ante assessments of adaptation investments and interventions to identify robust strategies.
- Engage in on-going monitoring using a clear "logic" model to track progress of the "robust strategies" on the ground. Ensure that the logic model is explicit about what constitutes successful adaptation for the outcome pathway.
- Take a learning approach to M&E with "stakeholders" at multiple institutional levels.
- Encourage data sharing across projects doing M&E of adaptation – there is a growing consensus around priority interventions (e.g. UNFCCC Nairobi PoW, Thornton and Lipper *et al*. 2013) and we have evidence about the success and impact of agriculture and food security interventions on key outcomes.
- Develop and use a tool for managing or evaluating impact given inevitable tradeoffs among food system outcomes.

Climate change and food systems

Climate change is already having major impacts. Increased variability in rainfall and temperature patterns has direct implications on agricultural productivity and the resultant availability of food. This is especially acute in vulnerable areas, which are threatened by high levels of food insecurity. This chain of events can be viewed as both complex and geographically heterogeneous and guided by a range of factors, which contribute towards vulnerability in the food systems (Fussel 2010).

Food systems and their resultant status of food secure or food insecure communities and populations are fundamentally affected by change; socio-economic and bio-physical, with climate change encapsulating many of the pressures on food systems and the resultant outcomes for communities. Uncertainty is an inherent attribute of future climate; this is further compounded by the complexities of food system linkages, both as a contributor to a changing climate through agricultural practices and yet highly vulnerable to the direct impacts of climate change. This creates a dynamic challenge to understand. Demand and supply of key resources to the future food systems will change; changes that are fundamentally inflicted, and to an extent controlled and linked to future shifts and fluctuations in local, regional and global climate patterns.

At a global level food systems are affected by overarching trends and drivers, which filter down to national and provincial levels and have implications through to communities and households. Drivers include population growth, dietary changes and influence, governance around food systems, agriculture commodity prices and changing market mechanisms. At a broad scale the effect of globalization and aspects such as subsidies and trade restrictions also have an influence. Due to these drivers multiple uncertainties exist when predicting future patterns with food systems including agricultural commodity prices, population and income growth, investments in technological change as well as institutional and policy change (Antle and Capalbo 2010).

In this frame adaptation, through projects and interventions, is a critical factor that will shape the future severity of climate change impacts on food production (Lobell et al. 2008). Ensuring this adaptation to climate change integrates food systems in their full complexity requires short-term decision and management of the systems to cater for immediate needs and

shortages. In addition longer-term decisions concerning systemic level changes are needed including technology investment and physical and social capital enhancements (Antle and Capalbo 2010). In order for informed decisions concerning adaptation planning to be made, a much clearer nuanced understanding of how climatic factors affect food and livelihood security is required (Warner et al. 2012).

This includes unpacking the linkages among climate, household livelihoods and food security profiles (Warner et al. 2012, Smith et al. 2008). In addition, analysis of the multiple causation pathways and complications is required, looking at the critical components that comprise food security. The four primary aspects are food availability (local or national level), food access (consumption) at household and individual level, stability of this access over time and food utilization leading to a sufficient nutritional status (IOB 2011).

Evaluating adaptation

Adaptation to climate change needs to be seen as an iterative process, where the likely state of the climate will not be at a stable equilibrium, rather an ongoing transient process (Pittock and Jones 2000; Stafford Smith et al. 2011). Therefore adaptation responses need to be viewed and shaped appropriately. The area of adaptation is relatively new, especially in the policy and implementation arena, meaning there is little in the way of good practice to draw on (Harley et al. 2008). At the outset designing an M&E system requires a critical appraisal of what impact an adaptation project will have and what 'additional' climate change adaptation elements to a development project are in place. These are both key questions that impact on the formulation of objectives and indicators for monitoring (Spearman and McGray 2011).

Monitoring refers to a systematic continuous process of tracking and reviewing interventions and activities and their results. This is within a bound context, with the aim of making adjustments to activities if deviations from the set objectives, targets or standards are found (Spearman and McGray 2011).

The process of critically evaluating the monitored data and relevant proxies follows the monitoring. Evaluation assesses whether longer-term strategic project or programme goals were attained effectively and efficiently and accountable to achieving impact. Different categories of evaluation exist which can be applied to adaptation, including formative evaluation which focuses more on ways to improve a project or programme while it is still

running, and often happens with ex-ante and mid-term evaluations (Pringle 2011). The alternative option is a summative evaluation, which seeks to summarize the effectiveness of the intervention after project or programme completion (ex-post) (Pringle 2011).

A growing trend in the adaptation literature emphasizes the importance of M&E, however it has primarily focused on the challenge of conducting M&E, namely the categorization of adaptation interventions into thematic areas for M&E application. Where evaluation does take place, it tends to focus on the process rather than the outcome of implemented policies and strategies (UNFCCC 2010). In addition the literature has focused on the identification of factors to be considered when implementing adaptive activities and the subsequent development of indicators (Adger et al. 2004; de Franca et al. 2009). The research focus on M&E has been to attempt to measure the impacts of climate change adaptation on interventions (Prowse and Snilstveit 2010).

As the definitions of how best to adapt, what adaptation entails and how it is 'additional' to development approaches continue to be debated, there is increasing necessity to develop robust monitoring and evaluation frameworks for adaptation. Current demand is shifting to the urgent need to share information and best practice especially around evidence of adaptation and detailed progress measurement. This is in part due to what M&E can potentially offer in promoting learning, as learning to adapt is as important as any specific adaptation intervention itself (Petengell 2010) and a critical component for developing effective programmes that allow adaptation to work (Frankel-Reed et al. 2009; Villanueva 2011).

Monitoring and evaluation for adaptation needs to form an evolutionary and iterative process where lessons learned and identified gaps all inform future measures and enhance adaptation efforts (UNFCCC 2010). Many of the larger agencies currently have multiple criteria for measuring such effectiveness of adaptation, however the criteria are not usually focused at a sectoral level. For example the guidelines used by the Adaptation Fund's Project and Programme Review Committee (PRC) entail multiple criteria for assessment of projects such as economic, social, environmental and cost effectiveness, however as Stadelmann et al. (2011) highlight these general criteria do not allow comparison of concrete adaptation effects even at a project proposal stage.

At a wider scale the Global Environment Facility (GEF) provides further examples of missing elements such as efficiency indicators and global targets for adaptation projects. This illustrates the 'moving goalposts' for adaptation M&E that make it hard to establish appropriate objectives and measures (Pringle 2011). In addition, not knowing the extent to which change may happen or how socio- economic responses will play out means it is difficult to evaluate the success or appropriateness of interventions (Pringle 2011). Therefore, when designing ex-ante assessments of adaptation, the focus should be placed on evaluating the value of the system under a range of conditions of the desirable objectives, rather than attainment of explicit goals due to the multiple uncertainties (Antle and Capalbo 2010).

Adaptive capacity and adaptive action

At the centre of climate change adaptation efforts are interventions to try and achieve a measure of adaptive capacity and stimulate adaptive action. The two processes and what they mean for an evaluation approach are described in Table 1. In practice an intervention may involve activities, which target both adaptive capacity and adaptive actions, however the distinction provides a practical way to conceptualize what is being evaluated and how performance and progress is most effectively assessed (Pringle 2011). This distinction is also relevant as the decision-making context is a major determinant of the monitoring and evaluation requirements and as such separate sets of indicators used to measure adaptation actions and building adaptive capacity are warranted (Harley et al. 2008).

Building an appropriate M&E framework

Where the focus is on adaptive processes and capacity, adaptation is measured upon interventions that address risk and vulnerability and attempt to foster learning and improvement. By addressing risk, the approach looks to address and quantify uncertainties of climate change outcomes in a particular context and situation. Success along these pathways involves a coherent decision stream, which integrates the contextual climatic conditions (and changes), vulnerability drivers and stakeholders' priorities and risk tolerance. In this frame the resulting M&E framework looks at the various elements of the process and considers the following questions (Spearman and McGray 2011):

- Quantity, relevance and quality of participant involvement in adaptation decisions

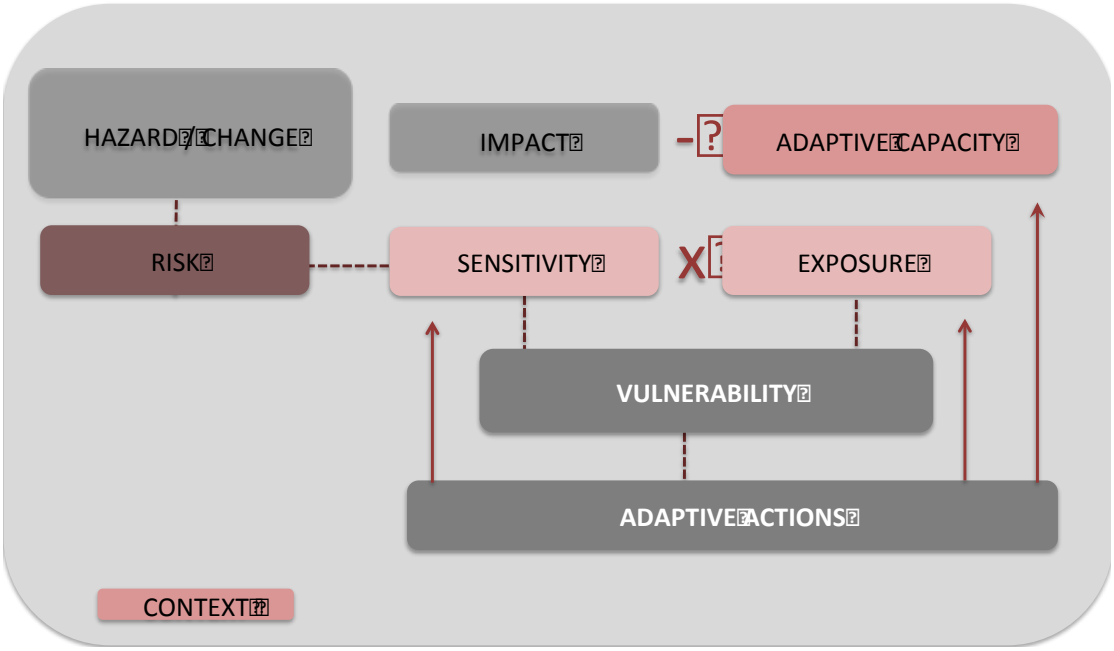
- How robust is the assessment of climate risks and vulnerability and the subsequent linking to relevant and targeted adaptation interventions to address these
- Sustainability of the adaptation process

Table 1: Description of adaptive capacity and adaptive actions

	Building Adaptive Capacity (AC)	Delivering Adaptive Actions (AA)
Definition	Building institutional capacity to respond effectively to climate change impacts by creating necessary regulatory, institutional and managerial conditions for adaptation actions. An intervention's aim falls within this adaptation dimension if it seeks to improve the quality and availability of resources needed to adapt, or if it addresses the capability to use those resources effectively (UNDP 2010)	Adaptive actions concretely address identified climate risks by directly reducing or managing these risks to a vulnerable population. This entails practical actions to reduce vulnerability to climate change as well as maximizing positive opportunities. Ranges from simple low tech and local solutions to large scale infrastructure projects
Activities	Convening & sharing information by research, data collection	Understanding risk and offsetting activities
	Awareness raising and training	Avoid exposure to climate change risks, e.g. moving localities or building local defenses
	Creating institutional frameworks which support adaptation, e.g. best practice guidance at a scales and context level which can be applied to projects, plans and strategies	Exploiting new opportunities e.g. engaging in new activities or practices to gain most advantage for a changes climate and local conditions
Time-scale	A longer term state of being for human and institutions, occurs over varying timescales	Concrete socio-economic and biophysical results achieved within a set timeframe.
Requirements	Having the skills, resources, and flexibility to adjust a course of action and prevail in light of changing conditions. Fosters forward thinking, planning, and laying the groundwork to avoid harm and capitalize on opportunity (UNDP 2010)	Desired results of activities that address known effects of climate variability or specific projected climate change impacts on a sector, community, or ecosystem
Evaluation approach	*Using proxies such as number of target groups with increased access to information and new skills acquired to utilize information. *At an institutional level evaluating the ability to facilitate and manage adaptation, a clear understanding of intervention additionality, including budget allocation and resources to capacity development	*Regular monitoring to understand if targeted activities have addressed specific risks or vulnerabilities as part of adaptation approach. *Systematic evaluation linking an implemented action, coupled with capacity enhancement to determine if activity has been successful in the time range of the evaluation. *Break actions into targeted themes to help understand linkages and feedbacks.

As Figure 1 illustrates, vulnerability is influenced by sensitivity and exposure to any given risk, within the context the adaptive actions are seeking to address. Therefore adaptive actions directly address these sensitivities and levels of exposure to the risk being targeted and feedback into the overall adaptive capacity. However it is important to realize this fits in an overall contextual situation with the linkage between the risk and vulnerability being dynamic and liable to change over multiple spatial and temporal scales. As a central pillar within vulnerability analysis, understanding the contextual perception of risk is critical as these are formed by past experience, the social and cultural environment, as well as the access to information (Grothmann and Patt 2005). Villanueva (2011) flagged this evaluation and perception of risk as a critical missing element in current evaluations of adaptation projects and programmes, and importantly as Villanueva (2011) alluded to: how capacity leads to action is not adequately integrated into evaluations, especially at smaller spatial scales.

Figure 1: Integrating vulnerability into adaptation M&E



Source: Authors

The result of interventions aimed at building adaptive capacity is that adaptation initiatives will focus at the level of identifying substantive outcomes, with emphasis placed on building specific capacities and reducing vulnerability over time. Attention is placed on evidence of change rather than specific interventions through which change occurs (Spearman and McGray 2011).

Interventions to promote adaptive actions focus more at a procedural level and on individual project actions. A useful distinction for evaluation to assess adaptive actions is the linkage to determinants of risk in the particular context and therefore direct actions seeking to address these. The focus on determinants is valuable when assessing how food systems interact with adaptation interventions, as it breaks down the evaluation process to understand how different elements target and interact with food system elements. This is an advantage to make the complexity of food systems more manageable.

Determinants can be defined as the set of available, applicable and appropriate indicators or metrics for a select intervention for a given exposure to climate risk at a particular location (Yohe and Tol 2002). Their application to adaptive actions is useful as they can be broken down into resources, human and social capital which can be outlined for the project or programme context. The focus on adaptive actions in an M&E approach is attractive as there is more scope for direct metrics, which in an evaluation lens are very useful for reproducing and remaining objective and transparent. Importantly metrics allow inter and intra comparisons, across spatial and temporal lines and institutions of various adaptation actions and give a snapshot of adaptation progress (Pringle 2011). However caution needs to be applied when using metrics in the context of adaptation, where no direct metrics exist for measuring adaptation progress itself (Pringle 2011). Indicators and metrics selected to support an evaluation of adaptive actions need to be supported by robust reasoning for their selection. This is to ensure we monitor improving understanding at the implementation level and not only what is measurable (Pringle 2011).

Adaptation categories

One of the widely recognized difficulties with evaluation of climate change adaptation projects occurs due to the blurry definition of adaptation itself and how to pinpoint interventions. Choices undertaken as part of farming practices, land use planning and infrastructural design may reflect considerations of current or future climate change but it is difficult to firstly isolate these and consequently evaluate them as individual adaptation components.

An important step in M&E when concerned with adaptation is to have a robust appreciation of the range of adaptation strategies being employed by a particular project, as detailed in Table 2. This then allows a subsequent assessment of the required indicators within the evaluation

exercise that allow a full evaluation of the strategy or range of strategies a project or intervention is employing.

Table 2: Range and description of adaptation strategies

Adaptation strategy	Description	Example of adaptation action
Prevent loss	Reducing exposure through various actions to impacts of climate change	Investing in rain-water harvesting and water storage for unpredictable precipitation conditions. Farmers in Senegal are being taught to interpret climate information to combat climate risks as part of regional CCAFS activities in West Africa.
Tolerating loss	Accepting loss where it is not possible or cost effective to avoid them	Accepting reduced crop yield, and placing greater emphasis on off farm income streams
Spreading loss	Distributing impacts over a wider population or geographic region, beyond those directly impacted by climate impacts	Insurance of assets. Index based insurance schemes are being implemented in Borana, Ethiopia for livestock and for crops in South Asia, as part of the CCAFS regional programs.
Changing location	Moving to an area of greater suitability and reduced impacts from climate change	Moving crops to a different village or locality to avoid water shortage impacts
Changing use or activity	Switching activity or resource use to one better suited to altered climatic conditions	Investing in new income streams and business opportunities. CCAFS has been promoting bee keeping with women farmers in the 'climate-smart' village of lower Nyando in Western Kenya. Other activities include keeping goats and poultry.
Restoration	Restoring assets as close to original condition after a climate shock or sustained period of change / damage	Re-building of assets e.g. household irrigation schemes after a flood

As it is an emerging field, a prudent step when evaluating adaptation is an examination of existing project categories to understand how targets for adaptation targets fit with these. For CCAFS this entails adding a sectoral focus on food security and inferring the food system linkages. Table 3 highlights some categories of adaptation and their food system linkages. However caution needs to be applied when trying to draw linkages between existing evaluation metrics and frameworks with adaptation, owing to the dynamic nature of food systems and transformations that may occur. As Hedger et al. (2009) recognized, the current need is not to 'foster an explosion' of evaluations of the multiple interventions which can be labeled as Climate Change Adaptation Interventions (CCAI). Instead they highlighted the importance of integrating adaptation efforts into existing metrics such as the National level

(Poverty Reduction Strategy Papers (PRSPs) with consequent integration to the National Adaptation Programmes of Action (NAPAs) (Hedger et al. 2009).

Table 3: Potential categories of adaptation to assess food security considerations

Category	Description	Food system linkages
Agriculture	World Bank (2009a) outlines three strategic objectives for adaptation efforts in agriculture: monitor climate change impacts on crops, forests, livestock and fisheries; support farmers and lenders in managing the risks of climate change impacts; and improve management techniques and crop varieties/livestock breeds to prevent crop and livestock losses due to climate change and increased pest pressures	Changes in crop yield, preferences, production, diversity and suitability have a substantial impact on the nutritional status of households and target communities. This includes both the nutritional status of communities and access to resources and market implications.
Water resources management	These include increasing storage capacity by building reservoirs and dams, improving water supply, desalination and extraction of sea water, water recycling to improve water use efficiency, changes in agricultural practices to reduce the demand for irrigation, improving water conservation and watershed management, and protecting natural resources such as forests (Prowse & Snilstveit 2010)	Interventions at root of both crop & livestock productivity and impact on yield and rearing and species diversity depending on water availability and access. Integral links within forests to harvested food products as additional food source.
Social protection	Refers to public, private, formal and informal efforts to support communities, households and individuals in their efforts to prevent, manage and overcome vulnerability. Examples include food aid, public works programmes, conditional and unconditional cash transfers as well as social insurance schemes for unemployment, old age and illness.	Integrates with food assistance with utilization and nutritional status of food a focus. Also cash based intervention, where supply and demand, availability, seasonality, trade and competition all integral factors in food system.
Community Based Adaptation (CBA)	An autonomous, bottom-up approach to adaptation, based on the premise that, through participatory learning and action, communities are best able to identify, prioritize and implement climate change adaptation	Targets multiple food system outcomes including utilization, where local preference through social value of food crop is strong. Also food availability with learning on production & distribution.

In order for M&E to be accurate it is integral to define not only what is to be evaluated, but also to define what 'success' is in order to establish benchmarks against which to evaluate programmes, projects or specific interventions (Tanguay et al. 2010, Reed et al. 2006). These two aspects then inform the development of an M&E framework including the set of relevant

indicators (Villanueva 2011). The Adaptation Fund Board (AFB 2010a) has developed useful guidance for forming adaptation baselines and targets as summarized:

- Review and synthesize existing information on current vulnerability, risk and adaptation measures based on previous studies, expert opinion and policy context.
- Evaluate and describe adaptation policies and measures in place, which influence the ability to successfully cope with climate variability.
- Develop baselines of vulnerability and adaptive capacity taking into account underlying historical trends over time, noting upward or downward trends over last 5-10 years drawn from records and context relevant statistics.

A robust consideration of both contextual and controllable variables is required to understand their role in defining 'successful' adaptation. This definition needs to be objective from the outset to ensure the development of an M&E framework that is comprehensive. The development of the baseline allows benchmarks at the appropriate scale of evaluation, e.g. households, community or district to be set in place and form appropriate targets to be generated for interventions (Spearman and McGray 2011). As benchmarking is necessary to assess the progress achieved in a particular context (Balaban 2011) this needs to remain central in the evaluation process.

Indicators

Indicator based analysis provides a useful methodology to assess the performance of a policy or project towards a set of goals. Indicators allow a more empirically- informed process to evaluate decision making, and in the case of climate change adaptation to justify and evaluate adaptation actions associated with specific investments and their underlying decisions (Miller et al. 2012). Once the conceptual ideas behind adaptation projects have been operationalized, the variables can then be tested empirically through the indicators, which essentially 'measure the concept to produce data on it' (Adger et al. 2004). A wide range of evaluation needs exist when considering the intended changes and impacts from adaptation interventions. Given this range of potential evaluation needs no single set of indicators for adaptation are universally applicable.

This is primarily because an indicator is a specific variable or piece of data, which has been assigned a specific role in the evaluation (Balaban 2011). In using indicators in policy and action-orientated research there needs to be an understanding that no 'one size fits all,' with

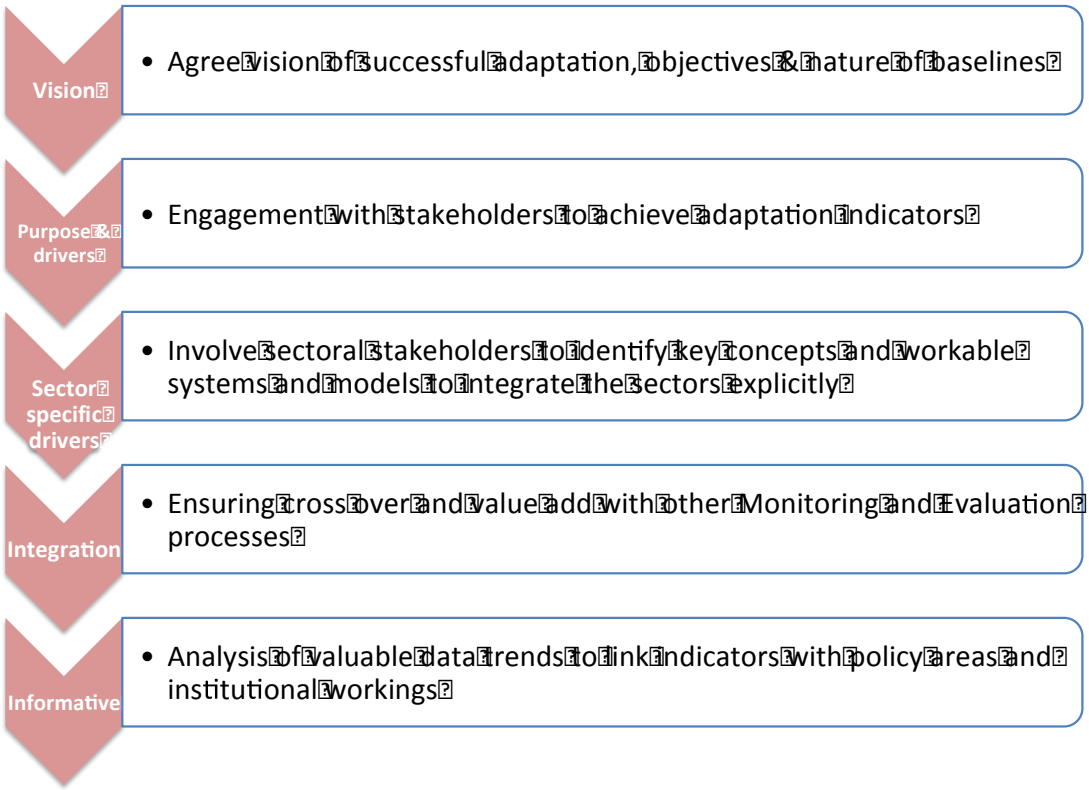
context being a determining and bias factor, with multiple indicator frameworks in use across different spatial scales (Shen et al. 2011). Important contextual factors include scale and aggregation in their impact on how reliable, robust and representative the indicators are (Eriksen and Kelly 2007).

Harley and van Minnen (2009) add a valuable set of questions to consider when conceptualizing and selecting relevant indicators:

- Availability – do appropriate data and indicators already exist?
- Potential availability – is reliable data available where indicators have not yet been developed?
- Representativeness – do the indicators measure progress on determining factors rather than less significant aspects?
- Continuity – are indicators readily rather than intermittently available?

Important steps in developing adaptation indicators are summarized in Figure 2.

Figure 2: Development of adaptation indicators



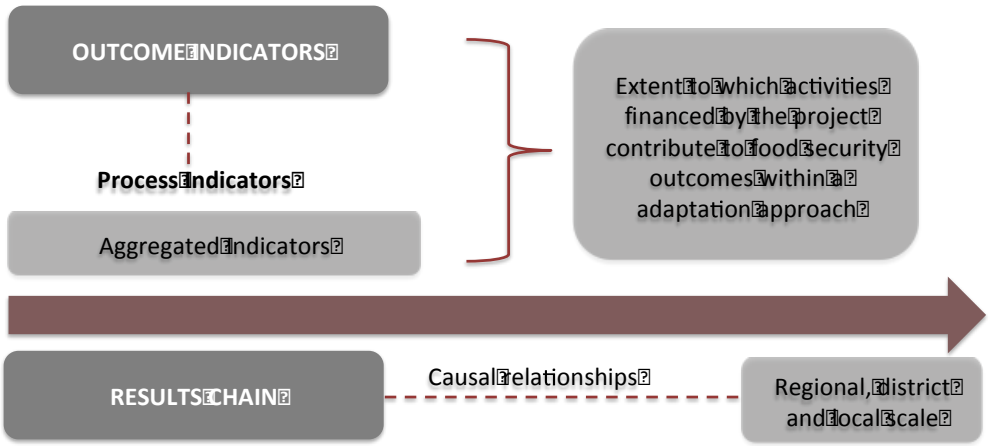
Source: Authors

Outcome and process indicators

In the development of indicators for adaptation projects, indicators can be split into process-based or outcome-based. Process-based indicators seek to define key stages in process that lead to optimum results based on a desired end point, however this does not have to be specified at the outset. This is an 'upstream' approach aiming to enhance capacity to a range of outcomes. The primary role of process-based indicators is to inform and justify decisions and allows project implementers and decision makers to progress strategically through the adaptation evaluation process. Outcome-based indicators aim to define an explicit outcome or end point of the adaptation action. This is a 'downstream' approach with the focus on the residual effects of risks. Consequently indicators are focused on longer-term effectiveness of adaptation interventions in the context of climate change impacts.

The differentiation between outcome and process indicators is important in relation to how a results chain can be generated to understand adaptation processes. This is especially relevant when considering different themes and sectors a larger adaptation programme may comprise. The value of using both types of indicators is that it allows causal relationships to be built and, in the context of a specific project , breaking down individual activities to see how they contribute towards food security elements across different spatial scales.

Figure 3: Adaptation M&E over longer time frames where outcome indicators represent longer causal relationships which play out at varying scales



Source: Authors

Process indicators primarily focus on helping support accountability of processes and finances within an M&E exercise. Outcome indicators alone are not suitable in the context of

evaluating climate change adaptation as dynamic changes associated with climate change operate over much longer time scales. These timescales make M&E challenging as a 'snapshot' evaluation is not able to objectively assess if specific interventions are 'working'. The value of integrating multiple process indicators is their application over shorter time scales, especially useful to support continuous feedback, capacity development and learning, however they do not provide firm quantitative evidence of change, e.g. specific damage averted (Spearman and McGray 2011).

When the M&E is focused on assessing achievement and success against set goals, outcome indicators measure broad impacts, which are partially but not exclusively brought about by an intervention (Lamhauge et al. 2012). At the outcome and output levels, process indicators come into effect, measuring more tangible achievements directly from an activity (Lamhauge et al. 2012). This is especially critical for using adaptation indicators to assess the impact of an intervention on food systems. This is due to the multiple short-term coping strategies such as migration, wild food crops, selling non-productive assets, reduced meal sizes and change of diet (WFP 2009), which are examples of activities employed to deal with impacts of climate change in a given context. Sufficient empirical evidence is lacking on the longer-term impact of these changes and whether they could constitute as a maladaptive actions. Therefore caution with the development of indicators must be made, as approaches often do not look directly at the distribution of vulnerability (Villanueva 2011). A balance of process and outcome indicators is essential for the M&E process to allow iterative and real-time changes to projects.

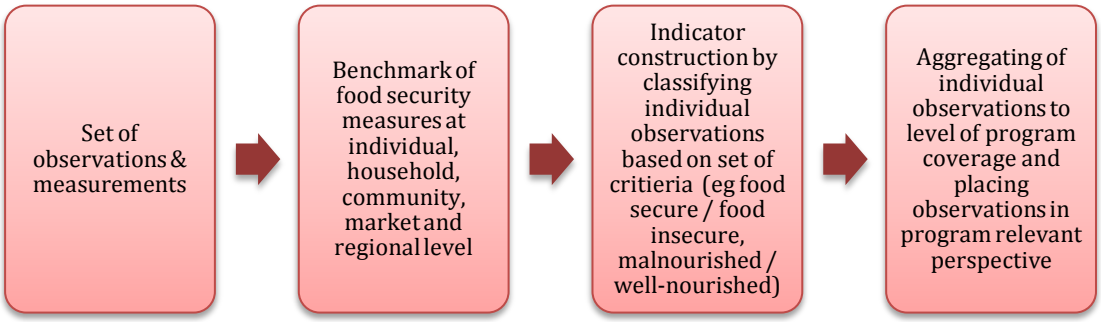
How is impact of climate change adaptation on food security being evaluated?

Projects and programmes with a sectoral focus such as water and infrastructure have largely targeted their activities towards policy mainstreaming and awareness raising (Lamhauge et al. 2012). Few evaluations of projects formally categorized as climate change adaptation interventions have been undertaken (Hedger et al. 2009). An initial scoping of adaptation project evaluations was carried out for this report and revealed limited explicit focus on food security, its key elements and how activities and outputs in a programme structure are focusing on food system elements. A lack of clear understanding of what constitutes food security (Ballard et al. 2011) and how to adequately measure impacts is a challenge for adaptation projects if they are to attain positive impact in addressing food security through the evaluation process. Within the structure of adaptation projects, food security is often grouped under agriculture with outcomes and indicators of measurement linking the two themes. Therefore current methodological applications to M&E largely do not break food security into its component parts when evaluations take place. Evaluation approaches, whether quantitative or qualitative, commonly utilize agriculture as the core theme, over which 'food security' is stipulated as a broad overarching goal. This grouping can be problematic due to what Webb et al. (2006) describe as the risk associated with relying on correlates, where causes and consequences may differ in the strength of the linkage and association to food security depending on the various contexts.

In this sense evaluations have lacked a critical analysis of which direct measures of food security are pertinent in adaptation, putting aside the integral issue of individual contexts. In light of this complexity each aspect of food security requires commensurate attention and relevant indications (Deitchler et al. 2011).

Figure 4 illustrates a traditional pathway of how food security indicators have been developed for projects.

Figure 4: Food security indicator development



Source: Adapted from Ridy et al. 1999

Adaptation Logic Model

In light of the lack of specific methodologies to address food systems in the adaptation process, an M&E approach using the Adaptation Logic Model (ALM) is proposed to integrate food systems. The ALM provides a good foundation for an evaluation process by giving clarity from the outset on the adaptation intervention being evaluated (Pringle 2011). A Logic Model approach to evaluating adaptation focuses on describing a program's theory of change, showing how activities connect to each other and the program aims and outcomes. The value of starting with this approach is to think beyond objectives and to integrate aspects such as scenarios of change in both unexpected and unintended outcomes.

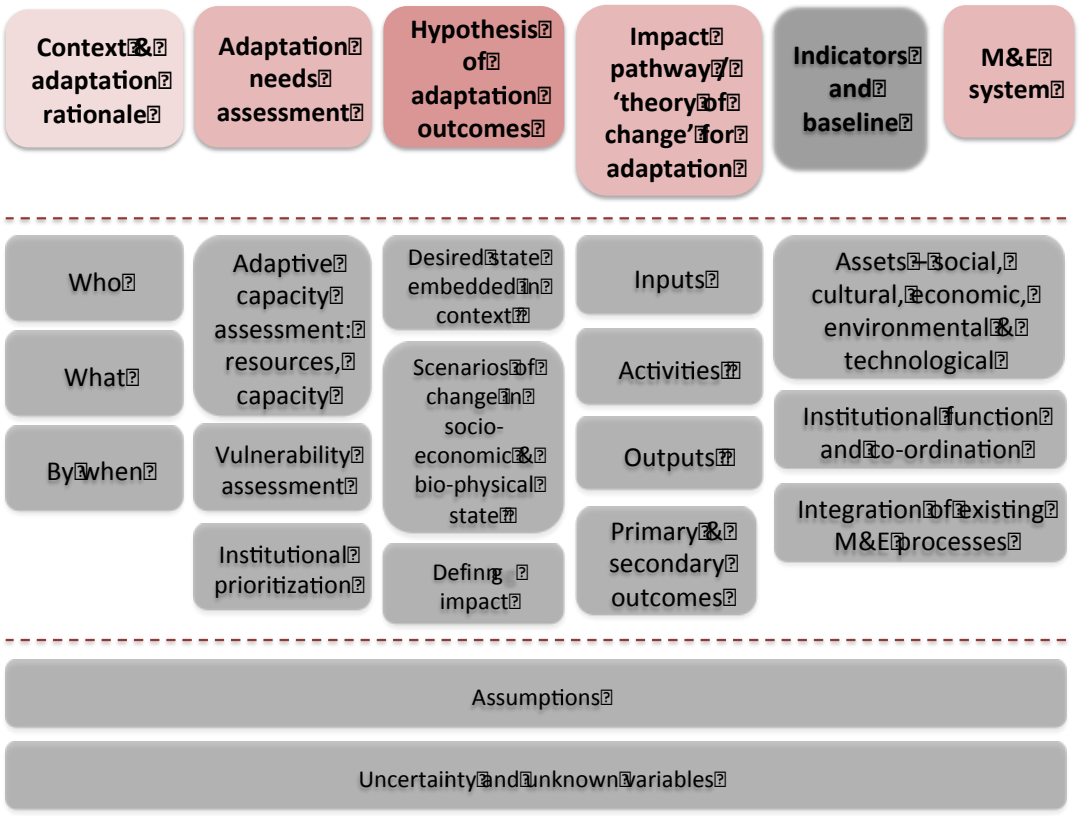
This is critical as many evaluation exercises fail to consider "maladaptation" as a potential outcome (Villanueva 2011). Barnett and O'Neill (2010) define maladaptation as "action taken ostensibly to reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups." A second issue is that adaptation success may ultimately be determined by the absence of a negative event or less change in the system than was predicted, requiring M&E to deal with measurement against a counterfactual scenario (Spearman and McGray 2011). To try to deal with this the ALM goes beyond traditional evaluations of performance, by providing and outcome orientated methodology to compare outputs and outcomes against programme purpose and objectives.

Developing the ALM within the context of a project allows an examination of the assumptions underlying the intervention as well as the logic of the set objectives, and traditional processes of evaluating whether the objectives have been met (Pringle 2011). The ALM focuses the evaluation exercise on contribution instead of attribution (Pringle 2011).

This is more appropriate considering the dynamic set of circumstances involved in adaptation; demonstrating the contribution of an intervention to the outcome, rather than attempting to link specific outcomes or impacts, is more realistic. This recognizes the variable conditions and future uncertainty surrounding adaptation programmes and projects, with many variables shaping the eventual (long term) attainment of an outcome, occurring over different spatial and temporal scales and not bound to the project timelines where evaluation is based.

This approach places more focus and emphasis on generating evidence to determine the type, nature and level of contribution from an intervention to specific outcomes and impacts. By understanding potential synergies and tensions from the planning stage, a more balanced evaluation approach is developed (Pringle 2011).

Figure 5: Framework components and process for ALM based M&E of adaptation project



Source: Authors

Figure 5 illustrates the various components of the Logic Model approach. Underlying the steps is the need to outline assumptions that occur, especially necessary for adaptation where longer time frames for change mean assumptions are likely to change within the context, due to multiple socio-economic and bio-physical drivers. As well as the assumptions an important

element is a clear understanding of the decision lifetime of the adaptation intervention, which is the sum of the lead-time (idea to execution of project) and the consequence time (period over which consequences of the decision emerge (Pringle 2011). This clear understanding of the decision lifetime, both to the intervention and the predicted consequences allows M&E to be planned in phases and complement activities to ensure best practice and continual improvements occur across the continuum of the intervention. Note that scenarios are often used in the ALM as a way to deal with future uncertainty.

Different objectives target either adaptive capacity or direct adaptive actions. Furthermore, for food systems, a cross-scale analysis is required. For example, at a household level food insecurity arises when negative shocks can no longer be mitigated using the available suite of coping strategies. Many shocks are intangibly linked to climatic factors, where bio-physical changes set off a series of linked events across scales which lead to food insecurity.

Assets are an important proxy to allow integration of household decision-making processes in an impact pathway. This includes decisions households make to divest assets or reduce food intake in times of high stress. Assets reflect the stock of available adaptation resources and are the foundation for taking adaptive actions including social, cultural, economic and technological options (Spearman and McGray 2011). This is particularly prevalent when evaluating interventions focused at highly vulnerable populations where adaptation options are largely determined by an asset base (Prowse and Scott 2008).

Through an assessment of food systems and their drivers, an ALM approach would assess how a given adaptation project has impact on both food system activities and outcomes.

Results Based Monitoring

The Adaptation Logic Model can be complemented by the inclusion of a quantitative measure. Results Based Monitoring (RBM) integrates an assessment of the quality of the implementation effort and the results (Spearman and McGray 2011). RBM is a form of management which encourages strong performance and greater accountability for a project on achieving results (ACF 2011; AFB 2010b). As RBM utilizes quantitative measures it must be applied with caution in the context of measuring adaptation. This is especially true in the context of M&E processes evaluating the impact on food systems. A blanket indicator approach under RBM could lead to a mis-interpretation of how an action has addressed food

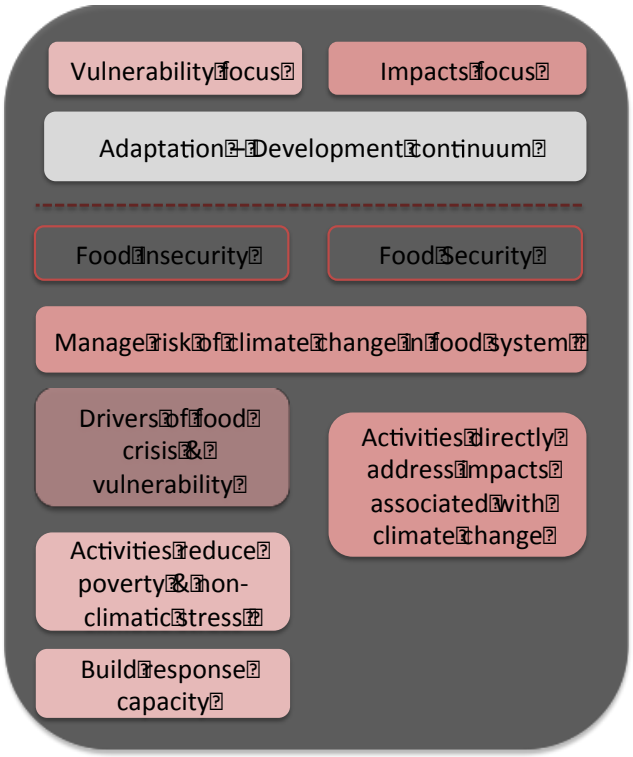
system components, and could result in an omission of indirect adaptation benefits from an intervention that may not be captured (IEG 2013). In addition when applying numeric indicators, Fussel (2010) further advocates caution when dealing with climate variability and understanding this and highlights the need to describe the context and the 'system' where the adaptation intervention has taken place.

The strategy behind a RBM framework is aimed at achieving important operational changes and improving performance (Binnendijk 2001). Consequently RBM consists of both measuring performance of a project or programme but also to learn and modify the design, which is critical for adaptation projects given uncertainty about the future. RBM frameworks applied to adaptation can incorporate monitoring and reporting at three distinct levels; programme or fund level, sectoral or level of intervention and project level (UNFCCC 2010). Tailoring RBM towards adaptation requires a consideration of longer time frames with M&E needing to track success in short (<5 years), medium (5-20 years) and longer term (20+ years) time horizons (Spearman and McGray 2011).

A method for evaluating food security in adaptation projects

A continuum exists between adaptation and overall development objectives, as climate change is one component potentially affecting development but not the only one (or necessarily the most important depending on context), especially in the short term. This continuum of actions ranges from more tradition development activities through to targeted and concrete adaptation measures.

Figure 6: Defining food security and insecurity within an adaptation - development continuum



Source: Authors

As Figure 6 illustrates, at the outset of an evaluation it is beneficial to understand where a specific project or programme sits on this adaptation – development continuum to determine if activities under evaluation have largely been focused on issues of food insecurity and therefore addressing vulnerability or have been more focused on enhancing food security and therefore targeting impact in achieving adaptation to climate change. This aspect of 'impact'

requires a robust approach to indicators, which adequately represent how food systems have been targeted, and interventions, which have served to enhance food systems and ultimately food security. This is particularly important with adaptation as evaluation approaches need to understand not only the set of actions undertaken to maintain capacity to deal with changes but also the decision-making processes associated with changes themselves (Park et al. 2012). We also recommend a clear focus on desired outcomes. As Table 4 reflects, there are multiple dimensions of food security that adaptation interventions need to target. Indicators selected should reflect food security itself as the primary impact and reflect household income and food production as proxy-impacts (IOB 2011).

There are widely accepted proxies for failure in the supply of food such as price hikes and lack of food to purchase, as well as reduced utilization ability such as malnutrition and disease outbreaks, but there are no exact indicators of access failure (Webb et al. 2006). Figure 6 illustrates the adaptation – development continuum within a food system context.

A large database of food security projects with direct food security indicators can be found, but very limited examples of direct indicators of food security for use in adaptation evaluations exist (see Annex 1 for range of food security indicators). An example from the Global Environment Facility of food security indicators used in their Adaptation and Monitoring Assessment Tool (AMAT) is shown in Box 2. As the example illustrates, food security is equated to changes in production over an annual period, with a subsequent adaptive capacity measurement applied to the indicators. The critique of such an approach is the failure of the evaluation to understand the key components of food security. Simply equating food security with production increases is misguided in evaluating how successful an adaptation project may have been in addressing food security. This neglects the multiple elements that constitute the four pillars of food security and fine scale variation that occurs.

Approaches to defining, understanding, and in this context measuring and evaluating achievements toward food security within adaptation projects and programmes need to appreciate historical and recent conceptual developments surrounding food security. These include what Webb et al. (2006) describe as a shift from using measures of food availability and utilization to measuring 'inadequate access' as the key proxy. In addition a shift is required from a focus on objective to subjective measures and an increased emphasis on fundamental measures rather than reliance on distal measures of food security. Webb et al.

(2006) make further justification of their description of subjective approaches of analysis with activities such as village surveys where respondents express concepts of hunger and food insecurity.

Box 2: GEF Adaptation and Monitoring Assessment Tool

Food security indicators:
% change in projected food production in targeted area given existing and projected climate change (food production is measured in tons/year)
% change in food availability given existing and projected climate change (food availability is measured in tons/year)

Adaptive capacity measurement from indicators:
Capacity perception index (Score) (disaggregated by gender)
The score ranges from 1 to 5 and below are the explanations of the rankings.
1. No capacity built
2. Initial awareness raised (e.g. workshops, seminars)
3. Substantial training in practical application (e.g. vocational training)
4. Knowledge effectively transferred (e.g. passing examination, certification)
5. Ability to apply or disseminate knowledge demonstrated

Although these subjective assessments provide valuable information, they ultimately express individual household members' perceptions and responses. These personal values and cultural ties reflect their status of food insecurity, which may not always coincide with an eternal or absolute standard or indicator (Webb et al. 2006). With a greater variety of activities implemented; the lack of a typical set of activities makes definition of a common set of indicators more difficult. This is especially true for indicators of the determinants of household food access, which are addressed through program interventions that include agricultural production, processing, and marketing; microcredit; and other income- and employment-generation activities. Because the interventions vary depending on the context, the appropriate way to capture their impact on the determinants of household food access is problematic (Swindale and Bilinsky 2006, Coates et al. 2007). The critical element is also the definition within the adaptation projects of what is considered as a 'food secure' status to use as the analysis point in the M&E activities.

In the frame of ensuring adaptation M&E is streamlined with existing processes, further caution is advised when using indicators integrated into agricultural assessments, where food security has most commonly been grouped in adaptation evaluations. These agricultural assessments have historically focused on physical thresholds (Antle and Capalbo 2010), with limited use of scenario analysis or implications of various development futures or socio-economic conditions. Consequently adding in the complexity of adaptation means the context and fit of these broad scale assessments must be carefully considered. Streamlining the process requires traditional metrics for food security and a range of indicators to be applied in a systematic format to allow for more robust approach to integrate food systems into adaptation projects.

A proposed methodology

We propose a method that first uses an ALM approach in combination with a clear conceptual framework (e.g. of food systems) to help get a clear focus on the desired outcomes from adaptation, as well as a sense of the time frame over which these will occur. The proposed logic model approach will work towards understanding how interventions have either targeted adaptive actions or adaptive capacity, which then allows formative indicators to be decided upon for the evaluation. However before selecting indicators a prior step in the methodology is to look at the food system interactions. This is to better critically understand how the project or intervention assessed both food system activities, such as production, processing, distribution and how these contribute to food system outcomes through utilization, access and availability of food (Ericksen 2008). This food system appraisal allows a better understanding of not only food security but also food insecurity.

Once a broad understanding of where the intervention undergoing evaluation sits on this continuum, the next step in the methodology is to break down the different dimensions of food security and understand specific adaptation targeting that caters to this. Suggestions for plausible adaptation targets under the different dimensions of food security are explored in Table 4.

Table 4: Dimensions of food security and adaptation requirements

Dimensions of food security	Adaptation targeting suggestions
Availability of food	Likely and documented reductions in agricultural production Reduced availability of ecosystem goods and services used for local consumption Increased pressure on food resources
Access to resources needed to acquire food	Food chain analysis to assess increasing food price patterns Loss of income due to damage to agricultural production and consequent impact on livelihood activities Increased migration to urban and peri-urban areas and consequent stresses on food system linkages Need to adjust agricultural practices and livelihood strategies
Utilization of food resources including nutritional considerations	Heat stress / weather fluctuations and implications on food borne disease Dietary / nutritional changes as food provision and availability changes Secondary impacts of contaminated water resources
Stability in food system	Historical pattern of supply with shocks and stress Disruption to income supplies from ecosystem goods and services Context related population and displacement due to food insecurity Potential for conflict around food system disruption

Applying the logic model to food security

In Table 5, we illustrate how a combination of a "logic model" and a "results based framework" could be implemented in practice. Drawing upon field-based indicators (see Annex 1 for more), we suggest how a logic model can be combined with process, outcome and impact indicators to monitor and evaluate how adaptation interventions interact with food security goals.

Table 5: Implementing a logic model approach to food system objectives

Key food system objective	Strategies to achieve this	Process indicator	Outcome indicator	Impact indicator
Enhance nutritional value	More nutritious food grown	Farmers' crop choices change	Foods with greater nutritional value harvested	Lower rates of micronutrient deficiencies
	Price of nutritious food reduced	Pricing policies implemented.	Households purchase more nutritious food	Lower rates of micronutrient deficiencies
More efficient use of scare resources	Revise input prices	Pricing policies implemented	Fertilizers use modified	Less fertilizer waste
	Implement land tenure	Tenure policies designed and implemented	Land tenure more secure	Land used more efficiently

An example of the methodology application using two different types of projects that take mainstream approaches to enhancing food security:

- Agriculture based interventions including horticulture, agriculture and agro-forestry
- Food aid and assistance, including distribution, food vouchers, food for work

An adaptation project grouped under agriculture may traditionally reflect food security as an issue largely of increasing production. However in order to usefully understand how production volume reflects progress in food security the impact on yield (kg/ha) needs to also be combined with an adoption rate. In addition aspects such as land tenure security play a critical role in how likely production value may increase. With secure tenure such as a formal land certificate, farmers are encouraged to invest in land to enhance production. However this stimulus of land tenure allows land to be rented or transferred, or shared as part of a market agreement (Deininger et al. 2008) all of which can contribute towards production. Production as an element of food system activities needs to also be seen with other activities such as distribution and the role of markets.

The prices producers can receive and food prices in general play a complex role in food security, with higher prices potentially increasing income for net producers but reducing food security for net consumers, motivating the need to also look at other trends such as food prices relative to wages (IOB 2011). However traditional M&E exercises which attribute only one indicator under production misses out on these key linkages. The example is illustrated in Table 6 below where the overarching goal may have been production increases but this has been broken down into sub-components and market elements – linking in multiple food system activities and potential indicators. This would then tie into M&E being able to propose more relevant sub-objectives for the adaptation intervention such as:

- Increasing production volume
- Developing value chains
- Helping reform market regulations
- Improving land tenure security

Table 6: Methodology example

Thematic Area Covered	Food system activities and outcomes targeted	Example Indicators
Agriculture, Food Aid	Production	Yield kg/ha % increase x adoption (ha) Value of the yield ($/ha and % increase in adoption)
	Value Chain	On farm added value $/kg and $/HH Off farm added value ($/kg)
	Market regulation	Price difference with producers and consumers (could further disaggregate rural and urban contexts)
	Land security	Number of farmers with certificate Area certified Number of farmers renting land (both out and in) Number of farmers with access to credit

A clear logical model of how adaptation will affect outcomes has to also account for tradeoffs among different outcomes, for example enhanced food production and other regulating ecosystem services, or nutritional quality of food and the price of food. Relationships and thresholds in production systems may lead to non-linear or abrupt changes (Stoorvogel et al. 2004) and consequently further influence decision makers of various actors in the food system Thus the analysis of progress (or contribution) towards outcomes has to consider that tradeoffs may be a barrier unless they are resolved. Another critical issue for adaptation to climate change is the uncertainty the future brings, so we cannot know today if a given intervention will still make sense in 10 years. Park et al. (2012) highlight how highly complex decisions with impact life-spans lasting several decades are often based on a limited understanding of possible outcomes and consequences.

Strategies for addressing the uncertainty inherent in climate change include using scenarios to identify "robust" adaptation options (Dessai and Hulme 2007) and looking for so –called "no-regrets" solutions (see Vermulen et al. 2013 for more discussion of this). Finally, maladaptation is always a danger; again the use of scenarios in planning can help to avoid these, but an ongoing learning-based approach is critical. Such an approach can be drawn from transition management frameworks (Loorbach and Rotmans 2010) which first establish a 'transition arena' to group the problem and allow a shared understanding of it as well as a set of guiding principles. The second step is the identification of options for transitions and an agenda with specific goals and objectives, as detailed in the ALM approach. The third area is

'experimentation' where diverse actors involved in these transition pathways are mobilized into scenario type exercise to understand various transition outcomes. The fourth process then looks at how the M&E approach and evaluation activity can stimulate a process of social learning amongst different actors involved. The evaluation process allows this concept of double-loop learning to inform programs like CCAFS where objectives are systematically revisited and the monitoring approach redesigned accordingly to better serve the purpose of systems change (van de Kerkhof and Wieczorek 2005).

M&E for climate change adaptation should have the enabling of such learning as its goal, so that programming can be corrected as tradeoffs become evident, interventions don't succeed in their intended impact or a key assumption about the future turns out to be incorrect. This allows M&E to actively and positively inform 'transformational' climate change adaptation where purposeful actions are made in response to impacts that have been defined as well as opportunities that have emerged (Rickards and Howden 2012).

Recommendations

We propose six main recommendations for CCAFS (or similar programmes).

- Agree on a common framework or outcome pathway with clear and agreed outcomes. A common framework keeps all stakeholders focused on the desired outcomes, as well as the best approach to evaluating successful adaptation.
- Use scenarios to handle the necessary planning under uncertainty, combined with ex-ante assessments of adaptation investments and interventions to identify robust strategies.
- Engage in on-going monitoring using a clear "logic" model to track progress of the "robust strategies" on the ground. Ensure that the logic model is explicit about what constitutes successful adaptation for the outcome pathway.
- Take a learning approach to M&E with "stakeholders" at multiple institutional levels.
- Encourage data sharing across projects doing M&E of adaptation – there is a growing consensus around priority interventions (e.g. UNFCCC Nairobi PoW, Thornton et al. 2013) and we have evidence about the success and impact of agriculture and food security interventions on key outcomes.
- Develop and use a tool for managing or evaluating impact given inevitable tradeoffs among food system outcomes.

Appendix 1: Food security indicators

Food security indicators are essentially a summary of the relative dimensions of food security used to demonstrate a measure of change from the set baseline. A wide and comprehensive array of food security indicators exist, which can be used across a project conception and planning however a critical appreciation of how the tradition components of food security, and their commensurate indicators affect the achievement of set adaptation goals has not been undertaken. This poses problems for robust evaluation, as using indicators without any empirical evidence of their association makes it difficult to construct a clear outcome (Webb et al. 2006) of adaptation interventions and improve their effectiveness.

Table 7: Range of food security indicators by component

Access	Utilization	Availability	Stability
Weekly market prices	Anthropometry of children under five	Food Supply Analysis and Self-sufficiency Ration	Areas affected by high crop loss caused by drought
Price Bulletins (white and yellow maize, white sorghum, beans, mixed teff, rice, matoke, cassava, millet)	Anthropometry of adult women (15-49)	Forecast Divisional Cereal Food Balances	Coping Strategy Index
Terms of trade: wage labor and staple food price	Mean and SD of weight-for-height, weight-for-age, and height-for-age for children under five	Number of meals eaten in one day	Sale of productive assets including land
Wholesale and retail food prices	Percentage of Population Consuming less than 1,890 Kcal/cu/day (Rural)	Area, production and yield of Food grain	Districts affected by landslides
Monthly HH food expenditure	Boys and girls (12-59 months) with Middle Upper Arm Circumference < 12.5 cm	Changes in the Per Capita Net Availability of food grain per day	Flood intervals
Food source of HH	Percent of population with calorie intake below 1805 kcal/cap/day	Prevalence of calorie intake below the threshold	World Food Programme Food distribution requirements
Percentage of HHs by income bracket	Prevalence of maternal Global Acute Malnutrition by Middle Upper Arm Circumference	Change in national cereal crop production compared to previous year (percent)	
Average travel time to nearest market centre	Percentage of Rural Households without Access to Safe Drinking Water	Food sufficiency status	
Food share of total household expenditure	Percentage of Rural Children Stunted (6 – 35 months)		
Percentage of households reporting perceived severity of the impact of food price rises	Percentage of Rural Women with Chronic Energy Deficiency (15 – 49 yrs)		
Poverty headcount index	Under-five mortality rate (deaths per hundred)		
	Body Mass Index		

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