CLIMATE CHANGE AGRICULTURE AND FOOD SECURITY

WorldFish

WHITE PAPER

SmartFarm Monitoring and Evaluation Framework and Strategy

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Final report
July 2013

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This publication should be cited as
Faulkner, L. (2013). SmartFarm Monitoring and Evaluation Framework and Strategy White Paper. WorldFish, Penang, Malaysia. White Paper: 2013-47.

Preface

This report is a deliverable under the Terms of Reference – SmartFarm M&E Framework Development, dated June 2013. The purpose of this report is two-fold. Primarily, to set out a monitoring and evaluation (M&E) framework and strategy for the World Fish Center's SmartFarm project. Secondarily, to link this framework and strategy to the wider CGIAR Climate Change, Agriculture and Food Security (CCAFS) Project and Aquatic Agricultural Systems (AAS) program, under which SmartFarm is a key component, as well as to existing World Fish M&E approaches. Recommendations to support progress towards a more integrated, flexible and transformative M&E institutional approach that incorporates a climate change lens are included.

To address the first component above, this report provides a complementary and coherent M&E framework that synthesizes and elaborates upon SmartFarm's existing system for monitoring and evaluating activities at project level that has to date been operationalized through a logical framework approach. Developed in close collaboration with key project stakeholders, including ultimate SmartFarm project participants and project staff, this revised M&E framework is intended to be the overarching guiding approach for managing results under SmartFarm, with the agreement of these stakeholders. This strategy document therefore builds on current project design and indicators identified for M&E processes by using a climate lens to refocus the identification of 'what' to measure in order to assess project effectiveness, and an outline for 'how' to measure it. This is achieved by adapting a new internationally recognized M&E for community-based adaptation (CBA) approach to fit SmartFarm purposes.

As a prerequisite to this M&E framework, this document also offers a draft Theory of Change (TOC). This is to support SmartFarm (and AAS under which the SmartFarm project will continue past the end of its initial project cycle in November 2014) with the design of its long-term adaptation programming strategy that aims to build transformative resilience for the poorest and most marginalized communities WorldFish work with through a sustainable development approach. Drawing on latest thinking on CBA effectiveness as reference to building climate resilience for most vulnerable groups through sustainable adaptation strategies, key stakeholders involved in the SmartFarm project collaborated to develop a participatory TOC in light of local context specificity. This bottom-up approach to project planning and design is useful. Only by knowing where SmartFarm project participants want to get to, can SmartFarm as a project understand how they aim to get there through the strategic choice of interventions on the ground that work towards building longer term effective CBA practice.

To address the second component above, this report will make linkages between the SmartFarm M&E system and the intermediate development outcomes (IDOs) and ultimate programming goals of AAS, current M&E approaches used by WorldFish Bangladesh, and existing global CCAFS indicators. This is required as WorldFish Bangladesh is currently working on establishing an M&E system applicable to all projects that is rooted in a Theory of Change programmatic approach. Recommendations provided in this document aim to identify strategies to mainstream adaptation to current and future climate changes into ongoing and future projects and programs through an integrative M&E system that includes planning and implementation processes. This approach uses a climate lens to further improve the efficiency of research and development-focused work undertaken by WorldFish, by fostering an institutional paradigm that does not view climate change resilience as an isolated specific goal pursued only by climate change specific projects. The SmartFarm M&E strategy in this report could potentially be used as a case study to aid the integration of a climate change perspective into larger WorldFish M&E systems.

Acronyms

AAS	Aquatic Agricultural Systems
ACC	Adaptation to climate change
ACV	Adaptation to climate variability
ARCAB	Action Research for Community Adaptation in Bangladesh
BAU	Business as usual
CBA	Community-based adaptation
CCA	Climate change adaptation
CCAFS	Climate Change, Agriculture and Food Security Project
CGIAR	Consultative Group on International Agricultural Research
CVP	Climate vulnerable poor
DRR	Disaster risk reduction
FFS	Farmer Field School
FGDs	Focus group discussions
HHs	Households
IDO	Intermediate development outcomes
LHs	Livelihoods
PRA	Participatory rural appraisal
TOC	Theory of Change
UP	Union Parishad
UZ	Upazila

Glossary of key concepts

Many terms related to climate change adaptation, resilience and M&E are subject to ongoing debate, and are therefore defined differently throughout relevant literature. This section of the report clarifies some of these key concepts as they are understood by SmartFarm.

Monitoring and Evaluation:

Monitoring: A set of actions that provide information about an initiative is at any given time (and over time) relative to activities, inputs, outputs, targets and outcomes. It can also be used to describe the systematic tracking of the contexts within which initiatives are carried out to identify status and to provide feedback for undertaking necessary measures. Monitoring deals with both quantitative and qualitative aspects. It is carried out on frequent and routine basis throughout the entire project period. Activity: An action that is necessary to transform inputs into outputs within a specified period of time.

Outputs: The direct consequence of activities/inputs – the project should be able to guarantee outputs if the activities/inputs are implanted and the assumptions hold true.

Outcome: The changes of benefits that result from the program.

Impact: This describes the long-term, sustainable change in state that SmartFarm will contribute to.

Indicators: The unit of measurement of changes. In a Theory of Change, indicators are generated against outcomes and ultimate impact in order to track change and assess results.

Assumptions: The conditions that must exist if the project is to succeed, but which are outside the direct control of the project.

Baseline: The first measurement of each indicator. It portrays the answers, 'where are we now?', 'how far we are from our destination?' and 'what made it to change?'

Logframe: A matrix of project/program objectives and their associated indicators and measurement requirements. It is a management tool that can be used in the design, monitoring and evaluation of projects and programs.

Theory of Change: A graphic representation of a casual model "results chain" to improve program design and evaluation by showing HOW and WHY a complex social change process will succeed under specific circumstances.

Climate Change Adaptation:

Adaptation: The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC 2007).

Adaptive capacity: The ability of a unit (individual, HH, group, system etc) to adapt. Under SmartFarm, the core components of adaptive capacity are access to basic resources, assets, institutions and systems that would enable a person or group to adapt to climate and other risks. Adaptive capacity is therefore underpinned by factors related to development – people living in development deficit situations have low adaptive capacity. Therefore projects and programs that focus on building adaptive capacity generally focus on lifting people out of the development deficit and so overlap with good development.

Vulnerability means: "The state that determines the ability of individuals or social groups to respond to, recover from, or adapt to, the external stresses placed on their livelihoods and well-being by (climate) hazards" (Wisner et al. 2004).

Climate vulnerability: Climate vulnerability has three core elements: exposure, sensitivity, and adaptive capacity. It therefore has an external dimension, represented by the 'exposure' to hazards due to climate variations; and an internal dimension, which comprises its 'sensitivity' and its 'adaptive capacity' to climate stressors.

Climate Vulnerable Poor: The poorest and most marginalized people living in climate sensitive districts with low adaptive capacity (Ayers and Huq 2013). This includes those people who are tipped into poverty and vulnerability by climate change impacts (ARCAB 2012). Climate vulnerable poor farmers are the target group for SmartFarm.

Resilience:

Resilience: The ability of a social or ecological system to absorb disturbances/effects and adapt to stress and change. It can be seen as moving beyond coping strategies towards achieving longer term development in spite of, or in light of, climate change (Dodman et al. 2009). From a development perspective, resilience is a process of building the securities of the climate vulnerable poor in ways that enable them to respond positively to climate-related shocks and stresses, and also address the myriad challenges that constrain lives and livelihoods. Resilience depends upon adaptive capacity. Higher adaptive capacity leads to better climate resilience for individuals, households and institutions (ARCAB 2012). SmartFarm understands resilience as the inverse of vulnerability: the more resilient a unit, the greater its capacity to adapt, and so the less vulnerable to any existing or impending hazard. In order to reduce vulnerability, adaptation needs to improve adaptive capacity in order to build resilience to climatic, and other non-climatic, hazards and risk factors.

Transformed resilience: This is the outcome of effective CBA and development practice as a first step in the process to achieving resilience at scale, resulting in the successful adaptation of climate vulnerable poor groups to climate change impacts through sustainable adaptation strategies (ARCAB 2012). This includes:

- Geographic scale: Resilience is achieved beyond isolated CBA projects. CBA is mainstreamed into long-term institutional structures; and activities are replicated beyond the immediate project boundaries.
- Time scale: Resilience is sustainable, with communities continuing to maintain and build resilience after project activities have finished.
- Beyond business as usual Resilience-building challenges existing development (and disaster risk reduction (DRR)) approaches, and retargets efforts towards building the adaptive capacity of the climate vulnerable poor to longer term, uncertain climate and other risks, not just current risks.

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Introduction

The WorldFish Bangladesh's SmartFarm[1] action research project has to date taken a logical framework approach to Monitoring and Evaluation (M&E). In line with the original project logframe, SmartFarm aims to contribute towards the overall objective that "a range of climate smart aquatic agricultural interventions in four villages in Bangladesh are widely adopted." The purpose is to identify, test, evaluate and promote climate change risk management and adaptation practices at household and community level in order to create "farms of the future" that implement optimized integrated farming systems. This is to ensure that present and future farming communities that possess low adaptive capacity and live in the climate vulnerable south-western Bangladeshi districts of Satkhira, Bagerhat and Jhalokhati, are better able to meet their income and food production requirements in light of local changing dynamic contexts of climate risk.

The existing project logframe states that this objective and purpose are the result of five outputs:

1. Climate smart interventions piloted at homestead level, with results analysed and recommendations made.
2. Development of integrated aquatic agricultural farming systems that enhance both productivity, food and diversity of fish within the farming system that are responsive and adapt to water and salinity management challenges.
3. Methods for equitable (gender-responsive) promotion, adoption and scaling up of climate smart farming methods in AAS developed and implemented.
4. Current weather prediction and forecasting systems documented and opportunities for improvements identified.
5. Experiences with current indexed-based insurance models used in Bangladesh and internationally summarized and opportunities for application in Bangladesh identified.

SmartFarm seeks to achieve these results through three streams of activities that are already operational:

- Climate smart interventions at homestead level through action research processes, including vertical agriculture and shaded pond culture, and a "climate-smart" housing system prototype in the high saline area project site.
- Integrated aquatic agricultural farming systems in the non-saline project site, including development of fish sanctuaries to increase seasonal fish survival rate and fish productivity in the light of changes of water level and increasing temperature in rice fields.
- Specific research agendas: (a) current weather prediction and forecasting systems in order to identify improvements; (b) the principle and potential of sorjan agriculture systems, and (c) existing lessons learnt and potential for index-based insurance models in Bangladesh.

An analysis of current development programming highlights a need to move beyond the current logical framework approach for better results, especially in light of climate change risk contexts in which all WorldFish projects and programs operate. Detailed reasoning for this is provided in this document, yet the main point to highlight here is that logframes do not facilitate rigorous M&E of complex social change initiatives that demand an outline of "how" and "why" change is expected to produce desired outcomes in order for what needs to be monitored and evaluated to be seen, as well as why, how and for whom. Among other constraints, the "missing middle" of logframes does not efficiently support linkages of how immediate project results influence change at higher outcome and longer term impact levels.

[1] SmartFarm is a 2.5 year project funded by the CGIAR and coordinated in South Asia by the International Water Management Institute (IWMI). It is delivered in the wider context of CRP7 (CCAFS), and has established synergies with ongoing CRP1.3 (AAS), CRP5 and CPWF projects.

The development of an agreed Theory of Change (TOC) is now increasingly seen as a prerequisite to ensuring a coherent results framework based on its outcomes driven approach that encapsulates change to be achieved rather than activities to be undertaken. This document uses relevant components of a new internationally recognized M&E for community-based adaptation (CBA) approach that utilizes participatory TOC as the backbone to refocus initial SmartFarm project planning as a necessary first step in developing an effective M&E strategy at local level.

As will be explored in this report, the revised M&E strategy for SmartFarm states the project aims to contribute to the long-term goal of strengthening livelihood resilience for climate vulnerable poor farmers in SW Bangladesh in light of climate and non-climate risks.

The project has three high-level outcomes:

1. Improved food security;
2. Improved income security; and
3. Increased aquaculture and agriculture production (enabling high level outcomes 1 and 2 above).

These outcomes are the result of six interlinking pathways of change:

i) Sustainable climate resilient aquaculture and agriculture initiatives (effective practice)
ii) Climate change knowledge
iii) Enabling institutional environment for adaptation and development (scaling up)
iv) Scaling out of sustainable climate resilient aquaculture and agriculture initiatives
v) Equitable access to market value chains
vi) Gender equity

Interventions identified through a participatory TOC approach contribute towards the achievement of the above outcomes. In this instance as SmartFarm is already underway, understanding where existing project activities described above fit into the overall SmartFarm TOC will be explored. Similarly, additional activities to be undertaken may also arise in order to achieve the above outcomes generated at community level.

The participatory TOC approach includes the development of a robust M&E system that is critical for ensuring the achievement of these results-based outcomes at local and program level. To achieve this, this report draws on the guidance provided by a new indicator framework for measuring CBA effectiveness that builds on the participatory SmartFarm TOC and is translated to fit project needs. How this refocus approach, framework and strategy for M&E under SmartFarm also links with wider WorldFish, AAS and CCFAS programming and M&E systems is discussed.

This report is structured as follows:

- Section 1 describes the background to the participatory Theory of Change approach;
- Section 2 presents the participatory SmartFarm Theory of Change, its linkages with wider WorldFish programming paradigms, and how it can be used to adjust institutional development planning design towards transformative approaches for building climate resilience;
- Section 3 builds on the section above with an M&E indicator framework for assessing the effectiveness of SmartFarm along with the provision of example mainstreaming indicators; and
- Section 4 provides conclusions and recommendations.

Section 1: Taking a Participatory Theory of Change Approach

1.1 From Logical Framework to Theory of Change

The SmartFarm project has followed a logical framework (logframe) approach to plan and design their existing M&E system. This means that the above project objectives have been entered into a matrix with indicators generated against each one in order to define what the objective looks like in measureable terms. The development of a logframe has been the primary approach used to design a results-based framework for different program elements, from which an M&E strategy and baseline can be designed.

However, it is increasingly agreed that the logframe approach has limitations in the current context of development programming. Existing practice and M&E approaches undertaken are not necessarily providing the rigorous results organisations and multi-stakeholders engaged in project landscapes are required to show "real" impact and therefore effectiveness of project processes used and results obtained. Inputs, activities, and outputs are all elements of a project. They are not by themselves a measurement of success or failure (Norad 1999), but their achievement is a necessary precondition. However, in order to effectively measure "results", we need to look beyond activities and outputs to assess whether these outputs result in outcomes and contribute towards impact. We also need to look at processes used that support the achievement of result outcomes.

Logframes facilitate "single loop learning" that hides the "missing middle" – i.e. how immediate project or program results influence change at higher outcome and longer term impact level (DFID 2012). Consequently, logframes are useful to see if stakeholders are doing activities well, but they do not necessarily support insight into if the "right" activities are being undertaken. Logframes therefore focus on what a project or program is doing, rather than on the long-term legacy of investments that requires a shift in focus towards what a project or program is going to achieve for ultimate project participants.

Moreover, as a project management tool, logframes assume stability of context and that social change is a linear process. They enable stakeholders to evaluate projects through more conventional M&E systems that usually occur at the end of a program cycle, with success of fixed plans measured against fixed contexts. There is limited scope for flexibility that enables stakeholders to respond to changes on the ground in light of changing contexts, and very importantly, what may not be working in practice. The opportunity for feeding such critical learning back into project design is lacking.

In response to these constraints, taking a theory-based approach to M&E that begins with a Theory of Change (TOC) as a first step towards the design of a rigorous M&E strategy is useful. This is because it facilitates the generation of a more specific, measurable and realistic description of a social change initiative that enables what needs to be monitored and evaluated to be seen, as well as why, how and for whom. This process takes development programming further, by demanding more specificity about goals and conditions needed to reach them – in other words outlining "how" and "why" change is expected to produce desired outcomes in order to bridge the "missing middle" mentioned above.

Box 1: What is Theory of Change?
Source: *http://www.theoryofchange.org/what-is-theory-of-change/*

[A] Theory of Change defines all building blocks required to bring about a given long-term goal. This set of connected building blocks - interchangeably referred to as outcomes, results, accomplishments or preconditions - is depicted on a map known as a pathway of change/change framework, which is a graphic representation of the change process.

A Theory of Change is developed from mapping outcomes backwards from the long-term goal through the intermediate and early-term changes necessary to reach the goal. Every outcome is tied to an intervention, revealing the often complex web of activity that is required to bring about change.

In mapping out each step to affecting change, all preconditions, assumptions and roles of different stakeholders are represented.

TOC forms the "backbone" of both development and more specific community-based adaptation (CBA) intervention M&E systems. This is because TOC provides ability to support understanding of why and how a project functions; provides a point of reference for checking progress while monitoring project activities; can be used to evaluate completed projects; and can inform future project design (WRI 2011).

Moreover, an M&E system driven from a TOC approach enables stakeholders to learn from and respond to contextual challenges and changing circumstances. As a "living road map" to be adapted in response to changing circumstances, the flexibility and responsiveness offered by TOC is essential when looking through a long-term climate change lens. This is because M&E becomes even more important, as providing effective support for both development and more specific adaptation projects means planning for an uncertain reality. A TOC is therefore an outcomes-based planning tool that allows stakeholders to support and respond to the messy reality of diverse contextual vulnerabilities contributing to climate risk for the poorest and most marginalized groups WorldFish aim to support.

Furthermore, the process used in participatory TOC design in this document is important. The "processes used" to deliver development and more specific CBA support, as well as the "results obtained" that indicate whether the implementation of project plans have achieved the desired impact, are both key. This is because assessing both components are required to move beyond "business as usual" (BAU) development approaches that largely lack the ability to foster sustainable resilience building in an uncertain and changing environment.

What this means will be discussed in further detail below, yet it is important to link here what the above discussion means for WorldFish. As a research center funded by the CGIAR group and international donors, WorldFish needs to produce both high quality research outputs for publication, as well as quantitative indicators of success in line with specific donor demands, which have to date required more "conventional" M&E approaches. However, WorldFish (and some of its CGIAR partners) is in the process of focusing more on effective process by moving towards integrating Participatory Action Research (PAR) into existing institutional M&E systems, taking into consideration project context-specific constraints for adopting this approach. For example, participatory approaches have been utilized to a certain extent within the SmartFarm project. Project design was based on the results of a participatory vulnerability and needs analysis at community level, and is currently being implemented with ultimate project participants testing various innovative approaches to support them in building more resilient livelihoods in light of current and potential future climate change impacts. Continuing to build on this process so it can become more comprehensive through its inclusion in M&E adaptation planning and project design would be beneficial.

Moreover, one interpretation[2] of TOC forms an integral component of the CGIAR approach with its utilisation to develop newly identified 'Intermediate Development Outcomes' (IDOs), which are progressivelyintegrated into WorldFish programming. Although this TOC approach was designed in collaboration with WorldFish research teams and relevant partners and is a useful step for the institution, it did not include community participation at local scale. A shift in WorldFish programming paradigms towards operationalisation of a more collaborative, inclusive, bottom up, participatory TOC approach would build on the strong foundations already established and further support WorldFish programming. A strong starting point for this approach is therefore the SmartFarm TOC, which was undertaken in close consultation with selected key male and female ultimate project participants (Appendix 1).
The development of TOC through participatory means is central to working towards "effective" or "transformative" processes. Community participation in project planning and management processes means that its outcomes directly target changes that contribute to supporting adaptation for climate vulnerable groups from their own perspective by reflecting their development and adaptation needs and demands. This means that climate vulnerable poor groups have started to be meaningfully engaged in adaptation planning design, rather than being recipients of uniform, top down, BAU development and adaptation investments. This latter point is particularly relevant for SmartFarm, which was initially largely driven by an extractive approach. This means the relevant WorldFish researcher and donor funding body designed the SmartFarm project based on the results of the initial participatory risk and vulnerability assessment and the research interests of the wider CCAFS program from a remote distance.

It is important to highlight that although this document utilizes participatory TOC for SmartFarm, which is a specific action research CBA project, participatory TOC is useful for all projects under the WorldFish portfolio. It can be used to design any development initiative to support a more transformative, rigorous and effective approach to high-impact programming.

1.2 Participatory Theory of Change Methodology

Based on the above, a clearly defined and usable participatory TOC is an important component of an effective M&E framework and strategy for the SmartFarm project. The participatory TOC approach has therefore been used as a prerequisite to developing the SmartFarm M&E framework at local project level, as well to support SmartFarm with their overall programming and strategy design. The overarching umbrella under which the SmartFarm M&E framework and strategy has been developed is based on the uptake and translation of a proven new participatory M&E approach specifically designed to measure the effectiveness of CBA: the ARCAB M&E for CBA methodology.

In line with current frameworks under development at the international level for successful M&E for adaptation, the ARCAB M&E for CBA system contributes to the existing gap in adaptation evaluation knowledge on (1) what constitutes effective CBA (including development as a key step in this process); (2) 'what' needs to be measured; and (3) an outline for 'how' it is to be measured.

The ARCAB M&E for CBA approach was initially developed for a new long-term action research program aimed at generating longitudinal evidence on CBA effectiveness: Action Research for Community Adaptation in Bangladesh (ARCAB),[3] to which WorldFish Bangladesh is a strategic Research Partner. This methodology is however universal in application and use. It has been adopted for this study based on its rapid recognition and uptake by the international community.[4] Moreover, it has also been adopted based on its development for an action research program, which has synergies with the programmatic approach undertaken by SmartFarm.

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[2] TOC can be interpreted in various ways and presented in different formats depending on the requirement and perspective of the institution or organisation in question. The participatory TOC approach presented in this report for SmartFarm is considered one of the most comprehensive.

[3] ARCAB is a long-term action research program on community-based adaptation in Bangladesh that is operational under ICCCAD, the International Centre for Climate Change and Development. ARCAB works with 13 partners who implement CBA projects across Bangladesh's five ecosystem/livelihood zones: ActionAid Bangladesh, CARE, Concern

[4] The practicability and accessibility of the ARCAB M&E and CBA methodology to stakeholders in different adaptation contexts is currently supported through its use in CBA projects across differing ecosystem and livelihood zones in Bangladesh and Africa, including Somaliland and Ethiopia with Save the Children International, and UNDP in Namibia.

Following this approach and as stated above, designing a draft participatory TOC with relevant project stakeholders is the first step in developing an M&E framework and strategy. Translating the TOC process through participatory means down to local scale and community level is an innovative approach instigated by ARCAB. This process provided an opportunity for joint learning and capacity building for WorldFish/SmartFarm project staff to ensure collective ownership of new development planning knowledge and facilitate M&E practice for CBA that contributes to transformational processes.

In order to design the participatory TOC for SmartFarm, the following PRA tools were used:

- **Step 1**: Risk and vulnerability assessment.

Risk and vulnerability mapping was undertaken to first understand what climate and non-climate vulnerabilities each community group perceived as important in order of priority in regards to agriculture and aquaculture based on the specific focus of SmartFarm, as well as what coping strategies are currently being undertaken to address these vulnerabilities. Experience of utilising the participatory TOC approach in practice has shown that engaging community stakeholders to think and discuss about their vulnerability in a language and format meaningful to them provides a good starting point for the next step in the process stated below, as communities are more able to envision their future outcomes over the next 10-year period if they first analyse what risks they currently face. The final SmartFarm TOC developed should therefore address the risks and vulnerabilities outlined in this first step. Please see Appendix 2 of this report for the results of the risk and vulnerability assessments undertaken during fieldwork.

- **Step 2**: Future scenario planning for participatory TOC outcome statement generation.

Future outcome statements were elicited from community members in order for project participants to voice what they want to experience in regards to agriculture and aquaculture long-term changes, using their current situation as a basis to measure change from.[5] After an agreed long-term goal was identified, outcomes were generated through backwards mapping and connected in pathways of change required to reach the long-term goal. Please see Appendix 3 for the individual participatory TOC's developed during fieldwork in each project site, which highlight the comparison between different stakeholder perspectives. For the overall draft participatory Theory of Change for SmartFarm, please see Section 2 of this report. This overall TOC synthesizes input from all community stakeholders into a single TOC.

Future outcome statements are best formulated in the present simple and present continuous tense, as if the outcome is already in place. For example, "communities knowledgeable on climate change" and "communities undertaking locally-meaningful and relevant adaptive agricultural practices." This future outcome sentence formulation helps project stakeholders envision future changes they wish to experience in real terms.

In order to develop an M&E framework with locally generated, context-specific priority indicators for the SmartFarm project, participatory indicators from male and female project participants were collected during fieldwork in line with the TOC outcome statements generated.

- **Step 3:** Indicator development for the above participatory TOC outcome statements.

[5] Future outcome statement and indicator generation activities used are synergistic with the 'Adaptation Visioning' Tool 3 in CARE/IIED (2012). However, the ARCAB M&E for CBA TOC approach builds on this tool and is more comprehensive in its development of a living road map to systematically guide each step of project programming and design.

The indicators generated reflected measurements of change for CBA initiatives up until the end of the existing SmartFarm project in November 2014, rather than the longer 10 year time period that the overall participatory TOC represents. This is because these indicators are required for current M&E project processes, hence this strategic decision was made during data collection itself. Please see Section 3 of this report for the results of indicator development for the TOC outcome statements undertaken during fieldwork.

Questions asked to generate indicators based on TOC outcome statements included:[6]

1. What do you want this goal to look like?
2. How will you know when this goal has been achieved?
3. Who do you want to achieve this goal?
4. What is the situation now? (For baseline measurement)

1.3 Research Challenges

A key challenge to this study was that the researcher undertaking data collection did not speak the local dialect at the field study areas. Complete reliance on translation of respondent information from SmartFarm staff was therefore depended upon. Possible interpretation of questions and therefore answers due to language differences is acknowledged for all respondents and translators. Similarly, the time allocated to undertake data collection was limited with fieldwork taking place in a restricted number of sites. This study does not include evidence from SmartFarm project participants in the following two field sites: (1) Chandipur, Satkhira District, Shyamnagar Upazila, Sadar Union, and (2) Gabgachia, Bagerhat District, Morrelganj Upazila, Daibgha Union. This research therefore is not representative of all project stakeholders within the SmartFarm project portfolio. This is because the time available for fieldwork meant that a strategic decision was taken to focus on fieldwork in project sites characterized by non-saline and high saline contexts. In addition, the time allocated for fieldwork made it challenging for the consultant to train the field team on the participatory TOC process and indicator generation prior to data collection. A learning-by-doing approach to field work was therefore undertaken. Moreover, the limited time available for fieldwork was a constraint on participatory TOC development with local stakeholders. Participatory TOC development can be an extensive process, especially when undertaken in close collaboration with a group of stakeholders due to the time required to adequately discuss, develop and agree on outcomes. Similarly, this participatory TOC development process was new to all community stakeholders engaged in the process. It therefore took time to initially support stakeholders with the thinking process required for this planning approach. In light of this, one key challenge was attempting to balance the need to help guide participants through the TOC process and provide helpful examples or information while at the same time not biasing community input and perspectives.

1.4 Ethical Considerations

False expectations of research outcomes were addressed by voicing clear intentions and conditions under which fieldwork was to be administered to respondents before data collection began. The right to not participate was adhered to, and for those that chose to contribute to this report, time allocation kindly given was subject to respondents' discretion to ensure livelihood and household activities were respected. All photographs were taken with permission.

[6] These questions are adapted from CARE/IIED (2012).

Section 2: A Participatory Theory of Change for SmartFarm

2.1 Background to the participatory SmartFarm Theory of Change

As is presented in figure 1 below, the participatory TOC developed goes beyond the scope of SmartFarm's existing project cycle that is due to phase out in November 2014, to developing outcomes representing the change SmartFarm project participants wish to see over a longer time period (i.e. 10 years). For development assistance to build transformative resilience for adaptation to future climate change and not just current climate variability risks that impact upon existing WorldFish initiatives, this long-term time horizon is key. Building the level of knowledge and capacity for effective adaptive practice to climate change impacts at household, community and institutional level is unlikely to be achieved within a relatively short timeframe (such as the length of an average NGO project). Moving beyond projectized approaches to planning to those that incorporate a longer-term outlook, along with more flexible and responsive systems to planning are therefore needed. Consequently, the participatory SmartFarm TOC presents a long-term living road map that will continue to develop to guide future programming that aims to increase livelihood resilience (and therefore reduce vulnerability) to climate change impacts for the poorest and most marginalized farmers SmartFarm (and AAS) work with.

Working towards the long-term change outlined in the participatory SmartFarm TOC can start to be initiated through activities undertaken in the current project. Key stakeholder engagement in the participatory TOC process confirmed how and why current project activities contribute towards SmartFarm's ultimate programming goal. It also highlighted what gaps exist in SmartFarm's current activities, providing understanding of what needs to be "added" to the project, or to future interventions operationalized under AAS, to fulfill community adaptation and development needs. Please see figure 3 for which outcomes are currently targeted by SmartFarm (in yellow), and which outcomes are to be addressed (in red).

Moreover, during participatory TOC development during fieldwork, community stakeholders provided more detailed information on activities and outputs (Appendix 3) that have not been directly included in the overall participatory TOC itself as TOC is an outcomes-based planning tool. These additional details that potentially guide interventions on the ground to support making progress towards particular outcomes are presented in figure 2 below with accompanying details in numbered notes that correspond to the circled numbers in figure 2.
Lastly, how the participatory SmartFarm TOC links to AAS planning and wider WorldFish M&E systems is presented in figure 4 below. As is shown, the SmartFarm TOC is intrinsically linked to AAS intermediate development outcomes (IDOs) and the long-term and short-term outcomes of its own TOC.
Please note, the TOCs shown below are best viewed on-screen in zoom mode or printed on A3 paper due to the size of the text.

2.2 The long-term goal

The ultimate desired outcome for SmartFarm is: Strengthened livelihood resilience for climate vulnerable poor farmers in South-West Bangladesh in light of climate and non-climate risks.
"Resilience" here is taken as the inverse to vulnerability, so it has been defined as the level of adaptive capacity of the target group (determined by their access to core resources, services and institutions that would enable them to adapt); and also a reduction in either/or exposure to climate impacts or a reduction in the sensitivity of critical assets to climate impacts.

2.3 High level outcomes

In order to achieve the above long-term goal, the SmartFarm TOC proposes three necessary high-level preconditions. The final high-level precondition specified below gives rise to six interlinking pathways of change. These high-level outcomes are:

- Improved food security;
- Improved income security; and
- Increased aquaculture and agriculture production (enabling high level outcomes 1 and 2 above).

2.4 Pathways of change

The following six pathways of change outline key outcomes that male and female stakeholders identified as necessary preconditions for reaching the high-level outcomes above. The themes of these six pathways are:

- **Pathway 1**: Sustainable climate resilient aquaculture and agriculture initiatives (effective practice)
- **Pathway 2**: Climate change knowledge
- **Pathway 3**: Enabling institutional environment for adaptation and development (scaling up)
- **Pathway 4**: Scaling out of sustainable climate resilient aquaculture and agriculture initiatives
- **Pathway 5**: Equitable access to market value chains
- **Pathway 6**: Gender equity

Pathways 2 and 3 above are integral to facilitating the achievement of pathway 1.
All outcomes identified under each of these six pathways are shown in figure 1 below.

Figure 1

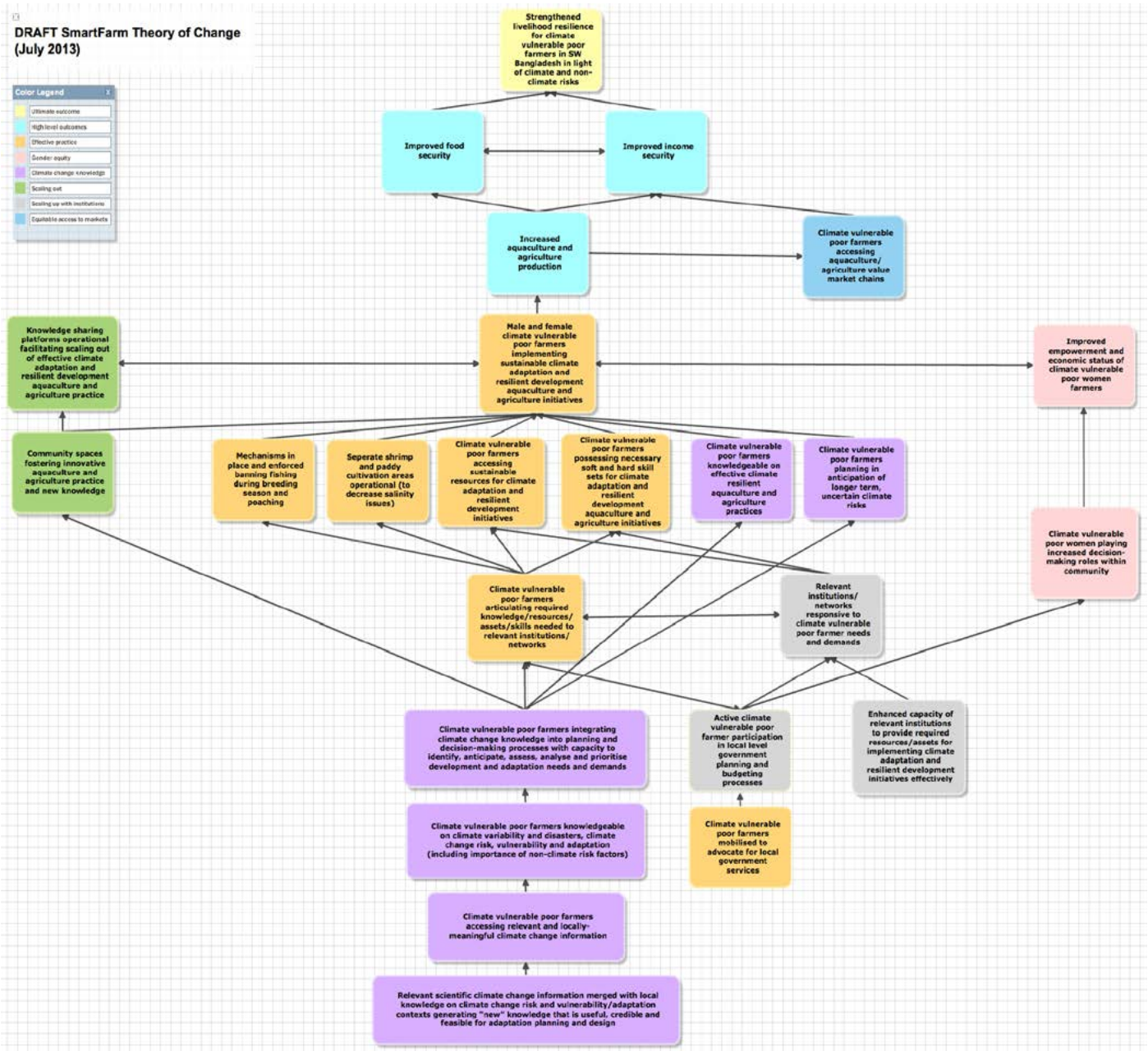
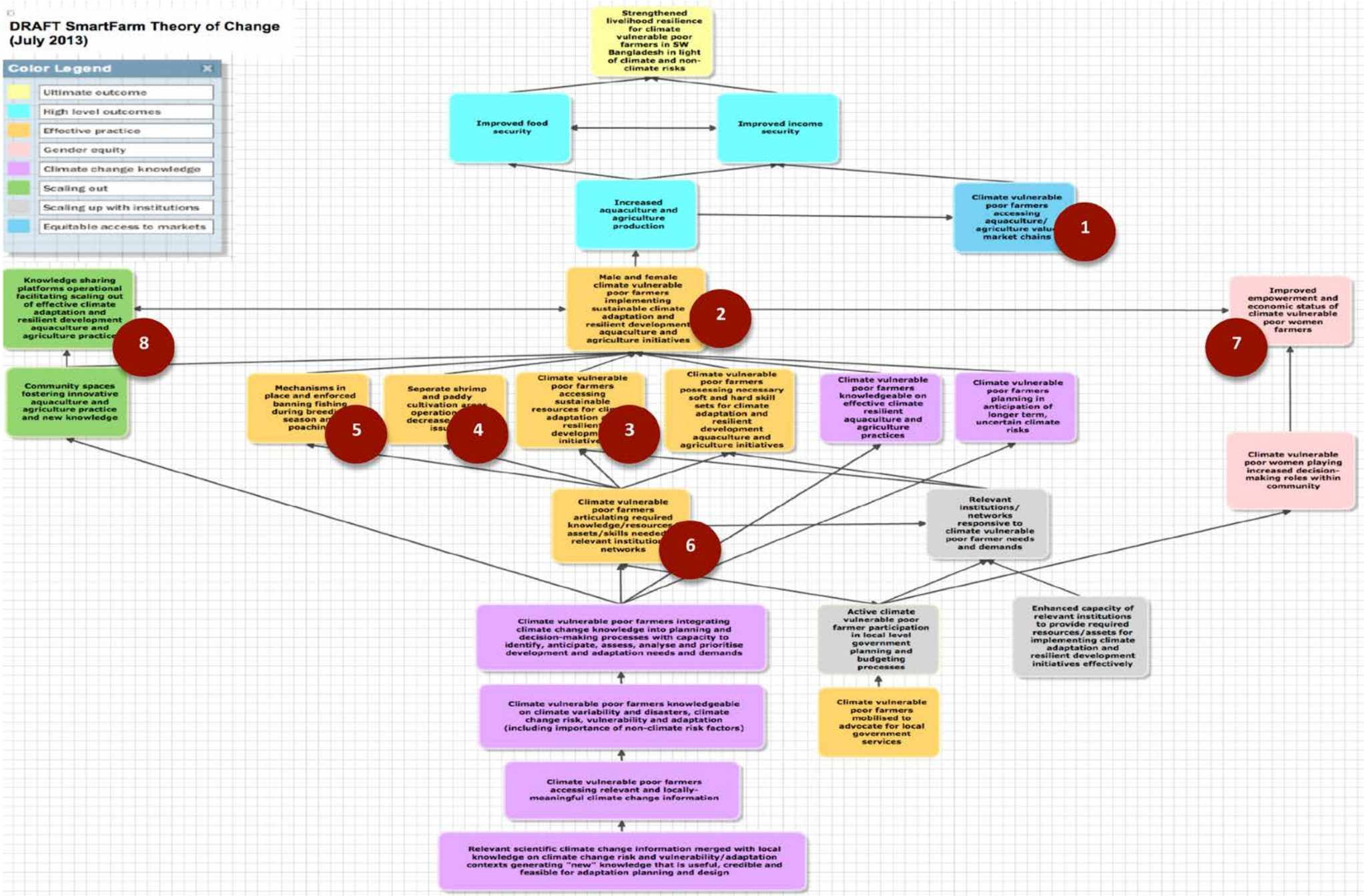


Figure 2


DRAFT SmartFarm Theory of Change
(July 2013)
Color Legend
Ultimate outcome
High level outcomes
Effective practice
Gender equity
Climate change knowledge
Scaling out
Scaling up with institutions
Equitable access to markets
Strengthened livelihood resilience for climate vulnerable poor farmers in SW Bangladesh in light of climate and non-climate risks
Improved food security
Improved income security
Increased aquaculture and agriculture production
Climate vulnerable poor farmers accessing aquaculture/ agriculture valu market chains
1
Male and female climate vulnerable poor farmers implementing sustainable climate adaptation and resilient development aquaculture and agriculture initiatives
2
Knowledge sharing platforms operational facilitating scaling out of effective climate adaptation and resilient development aquaculture and agriculture practic
8
Improved empowerment and economic status of climate vulnerable poor women farmers
7
Community spaces fostering innovative aquaculture and agriculture practice and new knowledge
Mechanisms in place and enforced banning fishing during breed season an poachin
5
Seperate shrimp and paddy cultivation are operation decrease issu
4
Climate vulnerable poor farmers accessing sustainable resources for cli adaptation resilient developm initiative
3
Climate vulnerable poor farmers possessing necessary soft and hard skill sets for climate adaptation and resilient development aquaculture and agriculture initiatives
Climate vulnerable poor farmers knowledgeable on effective climate resilient aquaculture and agriculture practices
Climate vulnerable poor farmers planning in anticipation of longer term, uncertain climate risks
Climate vulnerable poor women playing increased decision-making roles within community
Climate vulnerable poor farmers articulating required knowledge/resources assets/skills needed relevant institution networks
6
Relevant institutions/ networks responsive to climate vulnerable poor farmer needs and demands
Climate vulnerable poor farmers integrating climate change knowledge into planning and decision-making processes with capacity to identify, anticipate, assess, analyse and prioritise development and adaptation needs and demands
Active climate vulnerable poor farmer participation in local level government planning and budgeting processes
Enhanced capacity of relevant institutions to provide required resources/assets for implementing climate adaptation and resilient development initiatives effectively
Climate vulnerable poor farmers knowledgeable on climate variability and disasters, climate change risk, vulnerability and adaptation (including importance of non-climate risk factors)
Climate vulnerable poor farmers mobilised to advocate for local government services
Climate vulnerable poor farmers accessing relevant and locally-meaningful climate change information
Relevant scientific climate change information merged with local knowledge on climate change risk and vulnerability/adaptation contexts generating "new" knowledge that is useful, credible and feasible for adaptation planning and design

2.5 Additional community driven activities and outputs

The following activities and outputs were identified by community stakeholders during participatory TOC development as important for achieving the corresponding numbered outcomes in the TOC in figure 2. They are listed under the relevant pathway and outcome below (and can be seen in their original format in the individual Theories of Change in Appendix 3). The activities and outputs noted here are not exhaustive; rather they represent those issues that stakeholders raised as important during the TOC development process. Additional work with communities and stakeholders will be needed to determine the full range of interventions needed under the SmartFarm project to achieve the indicated outcomes.

Equitable access to market value chains pathway

1) Climate vulnerable poor farmers accessing aquaculture/agriculture value market chains outcome. This can be achieved by:
    - Community selling collective aquaculture and agriculture produce
    - Community accessing relevant market prices through mobile phones
    - Community accessing improved transportation to/from market that reduces crop damage

Sustainable climate resilient aquaculture and agriculture initiatives pathway

2) Male and female climate vulnerable poor farmers implementing sustainable climate adaptation and resilient development aquaculture and agriculture initiatives outcome. This requires:
    - Increased number of people understanding the role of fish sanctuaries in the rice fields. This requires:
        - Rings available at affordable prices
        - Regular ring knowledge sharing platforms with other stakeholders
    - Integrated farming systems operational (freshwater gheers)
    - Community producing hybrid fish in ponds. This requires:
        - Community knowledgeable on effective hybrid fishing

3) Climate vulnerable poor farmers accessing sustainable resources for climate adaptation and resilient development aquaculture and agriculture initiatives outcome. This requires:
    - Farmers using organic pesticides in paddy fields. This requires:
        - Increased farmer awareness on impacts of chemical pesticide use
        - Community producing organic fertilizer. This requires:
    - Community owning necessary agriculture equipment
    - Community using saline and flood-tolerant seeds for agriculture
    - Community using high yield and different varieties of good quality seeds. This requires:
        - Local seed bank established and operational by FFS. This requires:
    - Community buying quality seeds and conserving them appropriately. This requires:
    - Community undertaking new and pre-Aila seed production/preservation techniques
    - Community undertaking fish cultivation with good quality seeds and feed in line with latest technology/techniques. This requires:
        - Community accessing good quality seeds and feed
        - Community knowledgeable to identify best quality fingerlings and fry
        - Community using saline-tolerant fish species
    - Community accessing fresh water irrigation. This can be achieved by:
        - Community reducing pond salinity. This requires:
    - Community implementing effective pond salinity reduction techniques
        - Community using deep ponds
        - Piped water supply linked to community villages. This requires:
    - Union Parishad and NGOs supporting community implementation through hardware
    - Land owners agree to piped water supply. This requires:
    - Effective Union Parishad and NGO advocacy
        - Community using ponds in paddy for dry season irrigation

- Improved community access to fresh water through Union Parishad deepening canals
- Community undertaking rainwater harvesting for HH agriculture
- The above components require community accessing necessary funding streams. This requires:
  - FFS savings group cooperative operational. This requires:
- Community committee established

4) Separate shrimp and paddy cultivation areas operational (to decrease salinity issues) outcome. This requires:
   - Union Parishad enforcing rich land owners to not convert paddy land into private gheers

5) Mechanisms in place and enforced banning fishing during breeding season and poaching outcome. This requires:
   - Union playing a more influential role in fish production mechanisms. This requires:
     - Community mobilized to advocate for increased Union Parishad role
   - Community mobilized to maintain fishing ban during breeding season
   - Increased community awareness on how to stop fish poaching. This requires:
     - Active FFS advocacy on fish poaching
     - Community communication tools operational (e.g. pictorial sign boards)
   - Upazila Fisheries Office enforcing anti-fish poaching mechanisms

6) Climate vulnerable poor farmers articulating required knowledge/resources/assets/skills needed to relevant institutions/networks outcome. This requires:
   - Women organised and writing proposals stating demands to Union Parishad
   - Community mobilized to ask Union Parishad to confirm their attendance at **ward shova**
   - Bi-monthly coordination meetings between community and Upazila. This requires:
     - Improved community mobilization facilitating successful communication with Upazila. This requires:
   - Community leader elected through participatory processes
   - Community meeting place established and operational

Gender equity pathway

7) Improved empowerment and economic status of climate vulnerable poor women farmers outcome. This can be achieved by:
   - Women producing crops independently of male community members
   - Women undertaking crab fattening practices

Scaling out sustainable climate adaptation and resilient development initiatives pathway

8) Knowledge sharing platforms operational facilitating scaling out of effective climate adaptation and resilient development aquaculture and agriculture practice outcome. This requires:
   - Regular community knowledge sharing meetings on effective practice. This requires:
     - Village exchange visits undertaken. This requires:
   - Upazila advising community on appropriate village sites
     - Effective community demonstration sites operational
   - Knowledgeable farmers acting as Upazila extension officers disseminating effective climate resilient practices

Figure 3

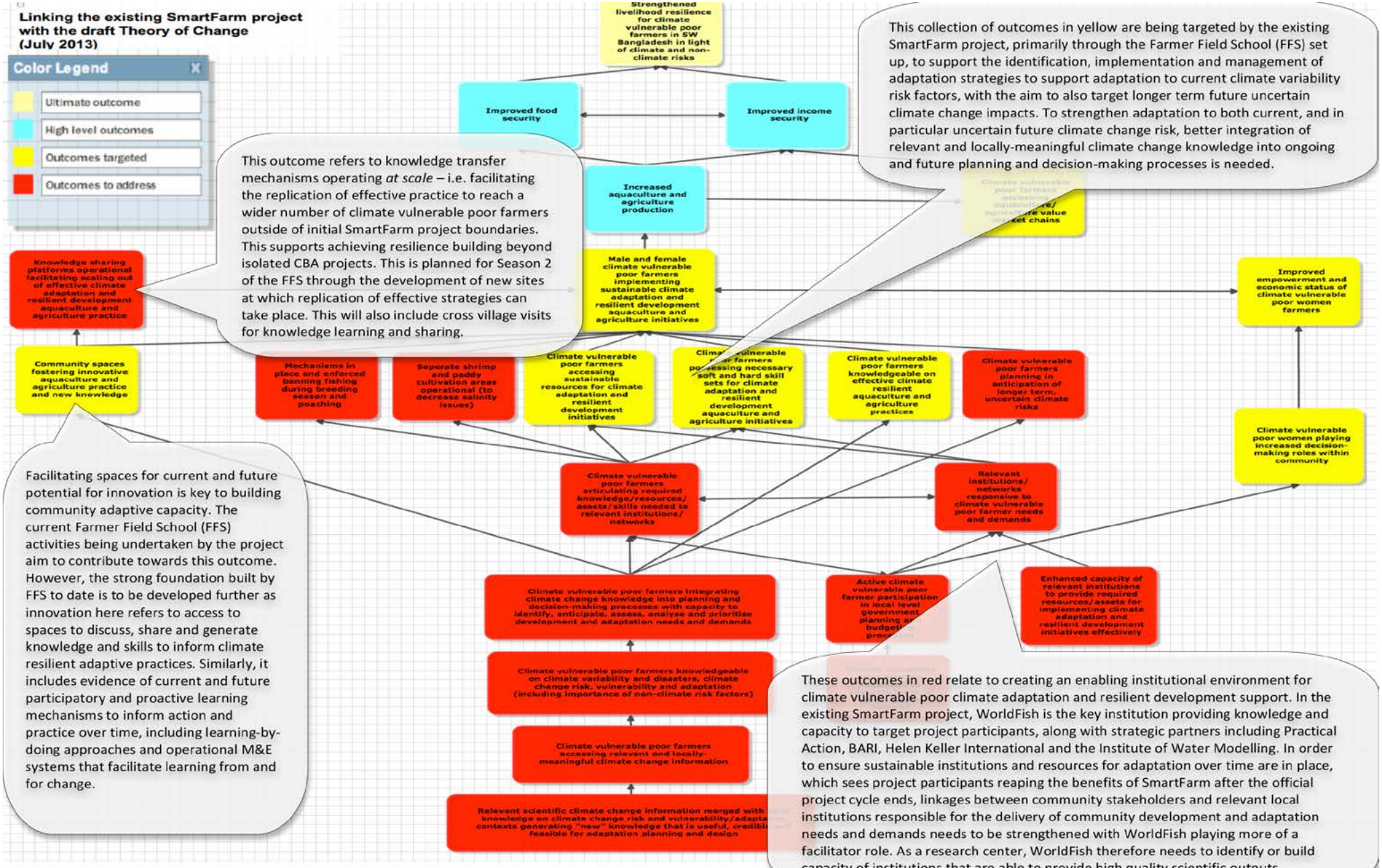
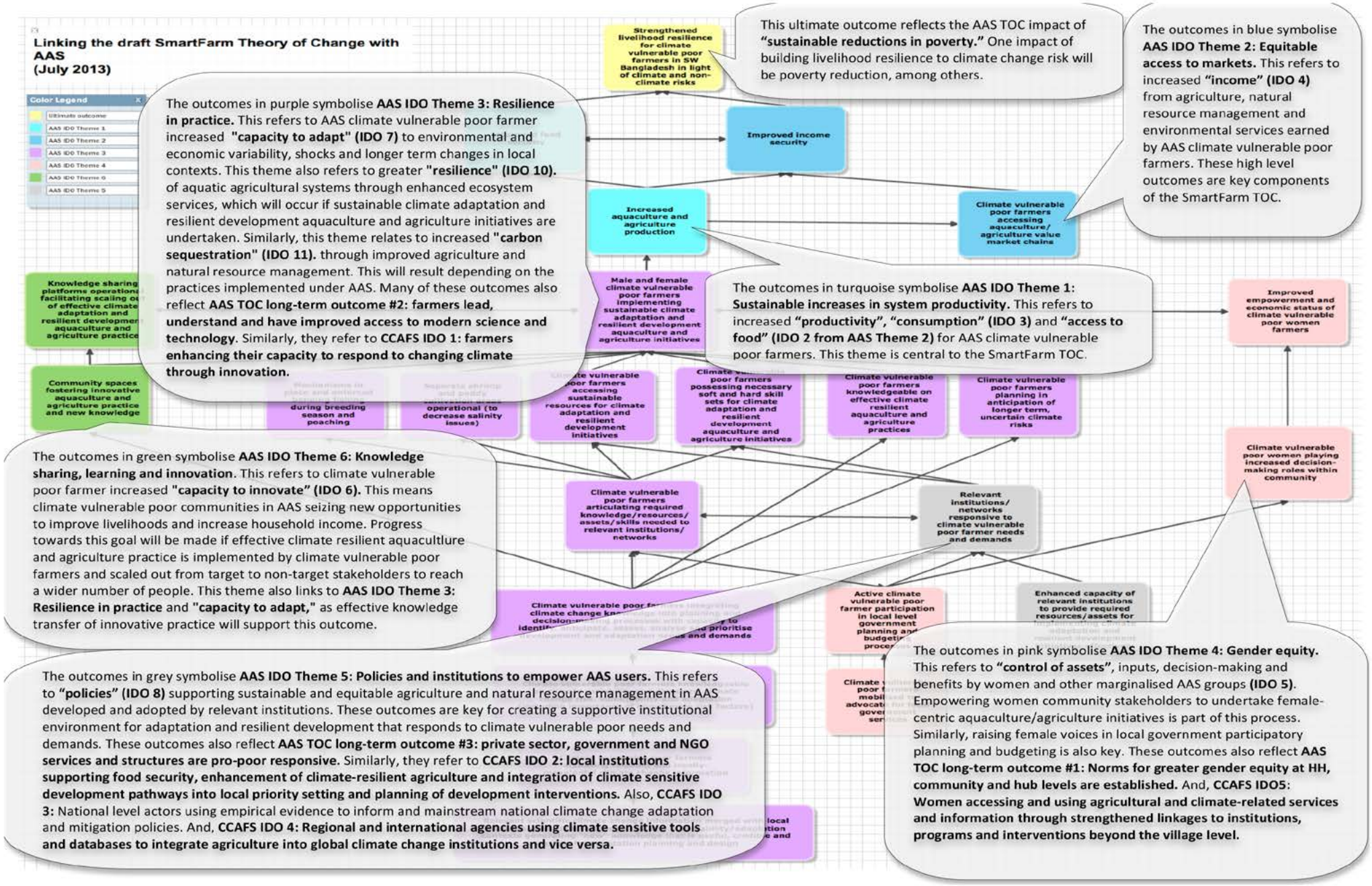

Linking the existing SmartFarm project with the draft Theory of Change (July 2013)
Color Legend
Ultimate outcome
High level outcomes
Outcomes targeted
Outcomes to address
Strengthened livelihood resilience for climate vulnerable poor farmers in SW Bangladesh in light of climate and non-climate risks
Improved food security
Improved income security
Increased aquaculture and agriculture production
Male and female climate vulnerable poor farmers implementing sustainable climate adaptation and resilient development aquaculture and agriculture initiatives
Improved empowerment and economic status of climate vulnerable poor women farmers
Knowledge sharing platforms operational facilitating scaling out of effective climate adaptation and resilient development aquaculture and agriculture practice
Community spaces fostering innovative aquaculture and agriculture practice and new knowledge
Mechanisms in place and enforced banning fishing during breeding season and poaching
Seperate shrimp and paddy cultivation areas operational (to decrease salinity issues)
Climate vulnerable poor farmers accessing sustainable resources for climate adaptation and resilient development initiatives
Climate vulnerable poor farmers knowledgeable on effective climate resilient aquaculture and agriculture practices
Climate vulnerable poor farmers planning in anticipation of longer term, uncertain climate risks
Climate vulnerable poor women playing increased decision-making roles within community
Climate vulnerable poor farmers articulating required knowledge/resources/assets/skills needed to relevant institutions/networks
Relevant institutions/networks responsive to climate vulnerable poor farmer needs and demands
Climate vulnerable poor farmers integrating climate change knowledge into planning and decision-making processes with capacity to identify, anticipate, assess, analyse and prioritise development and adaptation needs and demands
Active climate vulnerable poor farmer participation in local level government planning and budgeting processes
Enhanced capacity of relevant institutions to provide required resources/assets for implementing climate adaptation and resilient development initiatives effectively
Climate vulnerable poor farmers knowledgeable on climate variability and disasters, climate change risk, vulnerability and adaptation (including importance of non-climate risk factors)
Climate vulnerable poor farmers accessing relevant and locally-meaningful climate change information
Relevant scientific climate change information merged with knowledge on climate change risk and vulnerability/adapta contexts generating "new" knowledge that is useful, credibl feasible for adaptation planning and design
This collection of outcomes in yellow are being targeted by the existing SmartFarm project, primarily through the Farmer Field School (FFS) set up, to support the identification, implementation and management of adaptation strategies to support adaptation to current climate variability risk factors, with the aim to also target longer term future uncertain climate change impacts. To strengthen adaptation to both current, and in particular uncertain future climate change risk, better integration of relevant and locally-meaningful climate change knowledge into ongoing and future planning and decision-making processes is needed.
This outcome refers to knowledge transfer mechanisms operating at scale – i.e. facilitating the replication of effective practice to reach a wider number of climate vulnerable poor farmers outside of initial SmartFarm project boundaries. This supports achieving resilience building beyond isolated CBA projects. This is planned for Season 2 of the FFS through the development of new sites at which replication of effective strategies can take place. This will also include cross village visits for knowledge learning and sharing.
Facilitating spaces for current and future potential for innovation is key to building community adaptive capacity. The current Farmer Field School (FFS) activities being undertaken by the project aim to contribute towards this outcome. However, the strong foundation built by FFS to date is to be developed further as innovation here refers to access to spaces to discuss, share and generate knowledge and skills to inform climate resilient adaptive practices. Similarly, it includes evidence of current and future participatory and proactive learning mechanisms to inform action and practice over time, including learning-by-doing approaches and operational M&E systems that facilitate learning from and for change.
These outcomes in red relate to creating an enabling institutional environment for climate vulnerable poor climate adaptation and resilient development support. In the existing SmartFarm project, WorldFish is the key institution providing knowledge and capacity to target project participants, along with strategic partners including Practical Action, BARI, Helen Keller International and the Institute of Water Modelling. In order to ensure sustainable institutions and resources for adaptation over time are in place, which sees project participants reaping the benefits of SmartFarm after the official project cycle ends, linkages between community stakeholders and relevant local institutions responsible for the delivery of community development and adaptation needs and demands needs to be strengthened with WorldFish playing more of a facilitator role. As a research center, WorldFish therefore needs to identify or build capacity of institutions that are able to provide high quality scientific outputs.

Figure 4


Linking the draft SmartFarm Theory of Change with AAS (July 2013)
Color Legend
Ultimate outcome
AAS IDO Theme 1
AAS IDO Theme 2
AAS IDO Theme 3
AAS IDO Theme 4
AAS IDO Theme 6
AAS IDO Theme 5
Strengthened livelihood resilience for climate vulnerable poor farmers in SW Bangladesh in light of climate and non-climate risks
This ultimate outcome reflects the AAS TOC impact of "sustainable reductions in poverty." One impact of building livelihood resilience to climate change risk will be poverty reduction, among others.
The outcomes in blue symbolise AAS IDO Theme 2: Equitable access to markets. This refers to increased "income" (IDO 4) from agriculture, natural resource management and environmental services earned by AAS climate vulnerable poor farmers. These high level outcomes are key components of the SmartFarm TOC.
The outcomes in purple symbolise AAS IDO Theme 3: Resilience in practice. This refers to AAS climate vulnerable poor farmer increased "capacity to adapt" (IDO 7) to environmental and economic variability, shocks and longer term changes in local contexts. This theme also refers to greater "resilience" (IDO 10). of aquatic agricultural systems through enhanced ecosystem services, which will occur if sustainable climate adaptation and resilient development aquaculture and agriculture initiatives are undertaken. Similarly, this theme relates to increased "carbon sequestration" (IDO 11). through improved agriculture and natural resource management. This will result depending on the practices implemented under AAS. Many of these outcomes also reflect AAS TOC long-term outcome #2: farmers lead, understand and have improved access to modern science and technology. Similarly, they refer to CCAFS IDO 1: farmers enhancing their capacity to respond to changing climate through innovation.
Improved income security
Increased aquaculture and agriculture production
Climate vulnerable poor farmers accessing aquaculture/ agriculture value market chains
Knowledge sharing platforms operational facilitating scaling of of effective climate adaptation and resilient development aquaculture and agriculture practice
Male and female climate vulnerable poor farmers implementing sustainable climate adaptation and resilient development aquaculture and agriculture initiatives
The outcomes in turquoise symbolise AAS IDO Theme 1: Sustainable increases in system productivity. This refers to increased "productivity", "consumption" (IDO 3) and "access to food" (IDO 2 from AAS Theme 2) for AAS climate vulnerable poor farmers. This theme is central to the SmartFarm TOC.
Improved empowerment and economic status of climate vulnerable poor women farmers
Community spaces fostering innovative aquaculture and agriculture practice and new knowledge
during breeding season and poaching
operational (to decrease salinity issues)
accessing sustainable resources for climate adaptation and resilient development initiatives
poor farmers possessing necessary soft and hard skill sets for climate adaptation and resilient development aquaculture and agriculture initiatives
Climate vulnerable poor farmers knowledgeable on effective climate resilient aquaculture and agriculture practices
Climate vulnerable poor farmers planning in anticipation of longer term, uncertain climate risks
Climate vulnerable poor women playing increased decision-making roles within community
The outcomes in green symbolise AAS IDO Theme 6: Knowledge sharing, learning and innovation. This refers to climate vulnerable poor farmer increased "capacity to innovate" (IDO 6). This means climate vulnerable poor communities in AAS seizing new opportunities to improve livelihoods and increase household income. Progress towards this goal will be made if effective climate resilient aquaculture and agriculture practice is implemented by climate vulnerable poor farmers and scaled out from target to non-target stakeholders to reach a wider number of people. This theme also links to AAS IDO Theme 3: Resilience in practice and "capacity to adapt," as effective knowledge transfer of innovative practice will support this outcome.
Climate vulnerable poor farmers articulating required knowledge/resources/ assets/skills needed to relevant institutions/ networks
Relevant institutions/ networks responsive to climate vulnerable poor farmer needs and demands
Active climate vulnerable poor farmer participation in local level government planning and budgeting
Enhanced capacity of relevant institutions to provide required resources/assets for
The outcomes in grey symbolise AAS IDO Theme 5: Policies and institutions to empower AAS users. This refers to "policies" (IDO 8) supporting sustainable and equitable agriculture and natural resource management in AAS developed and adopted by relevant institutions. These outcomes are key for creating a supportive institutional environment for adaptation and resilient development that responds to climate vulnerable poor needs and demands. These outcomes also reflect AAS TOC long-term outcome #3: private sector, government and NGO services and structures are pro-poor responsive. Similarly, they refer to CCAFS IDO 2: local institutions supporting food security, enhancement of climate-resilient agriculture and integration of climate sensitive development pathways into local priority setting and planning of development interventions. Also, CCAFS IDO 3: National level actors using empirical evidence to inform and mainstream national climate change adaptation and mitigation policies. And, CCAFS IDO 4: Regional and international agencies using climate sensitive tools and databases to integrate agriculture into global climate change institutions and vice versa.
The outcomes in pink symbolise AAS IDO Theme 4: Gender equity. This refers to "control of assets", inputs, decision-making and benefits by women and other marginalised AAS groups (IDO 5). Empowering women community stakeholders to undertake female-centric aquaculture/agriculture initiatives is part of this process. Similarly, raising female voices in local government participatory planning and budgeting is also key. These outcomes also reflect AAS TOC long-term outcome #1: Norms for greater gender equity at HH, community and hub levels are established. And, CCAFS IDO5: Women accessing and using agricultural and climate-related services and information through strengthened linkages to institutions, programs and interventions beyond the village level.

2.6 Bridging the Gaps Between SmartFarm M&E Strategy and Wider WorldFish Frameworks

As is shown in figure 4 above, the participatory SmartFarm TOC reflects AAS IDOs and the long-term and short-term outcomes of its own TOC, as well as CCAFS IDOs. This is because the SmartFarm TOC and the programming goals of AAS and CCAFS are synergistic in taking a sustainable development approach to adaptation.

Adaptation interventions can be viewed on a continuum (McGray et al 2007). On one hand are adaptation measures targeted to address specific climate impacts, such as raising sea defense walls. On the other are those required for both adaptation and development, such as improved household access to fresh water sources for agriculture irrigation as is shown in the SmartFarm TOC. The former approach takes an 'impacts-based' approach to adaptation. This means climate change impacts such as floods or salinity intrusion are taken as the starting point for vulnerability assessments, giving rise to largely technological adaptation solutions that target the specific impacts of climate change through a top down approach. In comparison, the latter approach moves beyond "business as usual" development paradigms by viewing "adaptation as development" (Ayers and Dodman 2010). This sees adaptation as increasing the adaptive capacity of people to climate and non-climate risk by taking a livelihoods-based view to assessing vulnerability. Consequently, this results in adaptation interventions that target the underlying drivers of local context specific vulnerability factors and as perceived by climate vulnerable poor groups themselves through the use of participatory processes.

This distinction is important. Although not many WorldFish projects or programs are currently initiated with improving climate change resilience as a key goal, many development-oriented interventions implemented will likely still make important contributions to building climate change resilience as development and adaptation are not two separate programmatic paradigms. Although exposure to climate impacts is driven by climatic hazards, people's capacity to adapt to these hazards is determined by factors related to (under) development, including poverty and social and political marginalization, that render people unable to cope with and adapt to both climate and other non-climate related stresses (Ayers et al. 2013).

Climate change therefore poses a critical development issue. It does not operate in isolation of a broader set of factors, yet it does add a new layer of risk that is likely to exacerbate and intensify locally context-specific vulnerabilities already experienced by the poorest and most marginalized farmers and communities that WorldFish aim to support. Climate change is therefore not just an environmental concern, but an economic, social and political one as well.

Moreover, climate change is a new and dynamic driver of vulnerability that sets to change the landscape of risk in which WorldFish programs and projects operate (Ayers et al. 2013). Local contexts are likely to become more uncertain, with potential new risks posed falling outside the range of historical experience that may undo development progress achieved to date, and make future objectives harder to achieve (IDS 2013). Although climate change concerns may seem remote compared to immediate problems of poverty and food insecurity, its impacts jeopardize the ability to effectively address these core development priorities (OECD 2009). This includes the ability of development cooperation to eradicate poverty over the medium term, and support adaptation to uncertain climate change impacts long-term (Anderson 2011).

Keeping WorldFish investments 'on track' in light of climate change risk is therefore key (Brooks et al. 2013). Securing development outcomes requires minimizing to what extent climate change impacts may undermine planned development outcomes (Pervin 2013). To support changes in vulnerability and development status on the ground that lead to overall improved livelihood resilience in line with WorldFish goals and objectives, addressing climate change by integrating climate resilience building and adaptation into ongoing and future organizational development planning and decision-making processes, including M&E systems, that attend to both climate change adaptation and development in a synergistic way is highly recommended. This "mainstreaming" approach aims to generate double dividends: implementing development practice that is resilient, secure and sustainable against current and future climate impacts, and that which also builds local climate resilience for project participants (Ambani and Nicholles 2012; Ayers et al. 2013).

Taking into consideration all drivers of vulnerability, including climate, in the local context in which WorldFish projects and programs operate will enhance sustainability of outcomes. It will also avoid potential maladaptation[7] caused by development investments that can generate increased vulnerability for project participants long-term instead of leading to better future conditions. For example, a project that invests in strengthening agricultural and food security outcomes may invest in an irrigation scheme for farmers. However, if possible changes in rainfall variations under climate change scenarios are not considered, this process may not be sustainable long-term and therefore potentially contribute in part towards food insecurity.

Development practice undertaken by WorldFish therefore holds the potential to build a basis for longer term resilience-building for project participants in light of climate risk through current programmatic processes used and results obtained. Moreover, mainstreaming climate resilience and adaptation into WorldFish development projects and programs makes sense and avoids working at cross-purposes, making more sustainable, effective and efficient use of resources than treating adaptation separately from ongoing development activities (Lebel et al. 2012).

Furthermore, given the linkages between development and adaptation, mainstreaming adaptation into planning and decision-making processes within communities and WorldFish itself, does not mean doing something completely "new." Fundamental changes are not necessarily needed, as existing organisational processes used may already be generating a considerable amount of data that is compatible with climate change adaptation (Hedger et al. 2008). For example, improving food security and livelihoods outcomes will, in principle, help reduce vulnerability to many climate change impacts, as a more food secure and prosperous populace with improved access to resources is also likely to be in a better position to cope with and adapt to climate change (OECD 2009).

However, even so, WorldFish development efforts need to be strategic if they are to be successful. Current choices made and pathways followed will influence the future vulnerability (and resilience) of targeted stakeholder groups (OECD 2009).

Laying the right foundations is therefore critical. This encourages the use of a climate lens to rethink the way existing development, and indeed CBA itself through the SmartFarm/WorldFish action research approach is done as part of the process towards adaptation to climate change (ARCAB 2012). Although adaptation is grounded in development practice, it is 'good' development practice that is needed for sustainable development outcomes and therefore ultimately successful adaptation long-term. 'Good' development means it is to be considered 'transformative' if it is to be effective and build resilience at scale across three key components (ARCAB 2012):

- **Geographic scale:** Resilience is achieved beyond isolated development projects. Effective practice is mainstreamed into long-term institutional structures (scaled up), and activities are replicated beyond immediate project boundaries (scaled out).

- **Time scale:** Resilience is sustainable, with communities continuing to maintain and build resilience after project activities have finished.

[7] Maladaptation is defined by the IPCC as "any changes in natural or human systems that inadvertently increase vulnerability to climatic stimuli; an adaptation that does not succeed in reducing vulnerability but increases it instead."

- **Beyond business as usual approaches:** Resilience-building challenges existing development approaches, and retargets efforts towards building the knowledge, capacity and practice of vulnerable groups to longer term climate and other risks, not just current risks. In regards to development practice, this includes, for example, revisiting existing development to ensure the basic needs of project participants are met; that vulnerable groups are empowered to ensure that their knowledge and demands are reflected in decision-making processes; moving beyond short-term projectized planning to integrated approaches that engage with and build the capacity of local to national institutions, with associated sustainable institutional and resource bases; creating spaces for knowledge sharing and knowledge transfer, to support the scaling up and scaling out of effective processes and practice; and ensuring flexible approaches to planning that can respond to changing needs and incorporate a range of knowledge bases, especially that generated by ultimate project participants.

As transformative development is an entry point for effective adaptation, the above components also apply to adaptation. The main difference however is that adaptation is also driven by the integration of new knowledge about adaptation and potential future climate change (ARCAB 2012). This knowledge is co-produced from both improved scientific information about future climate change impacts and adaptation science, and locally-generated knowledge from vulnerable groups about past climate trends and the interaction between climate impacts, vulnerability and adaptation. This blending of scientific and local knowledge is transformational, because it requires development practitioners to rethink the way development planning and implementation are undertaken. Science clearly shows that our climate is becoming less predictable and more unstable. As the future becomes more uncertain, a lens that provides more dependable information on possible outcomes at the local scale is needed in order to understand what matters to local people. Relying solely on scientific expertise is not enough. Local knowledge is also needed to develop a new kind of knowledge that all stakeholders can use in practice.

On the ground it may look like there is very little difference between adaptation and development (Ayers and Huq 2013). However, it is not what is being done at the community level, but why, and with what knowledge - or more specifically, whose knowledge that is key. As community stakeholders themselves are the active agents of change for adaptation, the most effective and sustainable way of supporting them is to respond to their requirements. At project level, these will more likely be factors related to development that enhance capacity to adapt not just to climate but to other risks as well (ibid). Effective adaptation is not therefore just about new climate change information and adaptation science. It also requires transformative development approaches to be operationalized, along with associated transformations in attitudes, skills and actions.

This understanding is reflected in the participatory SmartFarm TOC, where outcomes comprise of transformative development and those more catered towards adaptation through the climate change knowledge pathway. By taking a transformative approach to project planning and M&E system design, the SmartFarm TOC encapsulates key outcomes that are useful not only for SmartFarm, but for other WorldFish projects and programs as well based on its comprehensive approach to building resilience for project participants in light of climate and other non-climate risk factors.[8] The participatory SmartFarm TOC therefore acts as a case study, or entry point reference guide, to start harmonising ongoing and future WorldFish projects and programs towards sustainable investments in light of climate change risk.

This will require "adjusting" existing WorldFish planning and management processes towards a more integrated and long-term operational paradigm by mainstreaming adaptation into ongoing and future development decision-making. One way of making progress towards this is through the integration of climate change adaptation indicators into ongoing M&E frameworks. For examples of mainstreaming indicators, please see Section 3 of this document that discusses the indicator approach to be used.

[8] Knowledge generated through the development of the TOC developed in close collaboration with INGO partners under ARCAB outlining how to make progress towards effective CBA (termed "transformed resilience") provided background support for the development of the SmartFarm TOC. The ARCAB TOC is presented in Appendix 5 for WorldFish reference.

To further support conceptual understanding of the shift in development approach towards transformative approaches, referring to another component of the selected M&E methodology used in this document is useful for WorldFish. For further details, please see "The CBA Resilience Scale" detailed in Appendix 4.

This information on mainstreaming and what constitutes transformative development as a key first step towards building climate resilience for project participants is important not only for WorldFish, but also for WorldFish partners who are responsible for taking to scale effective practice identified through WorldFish projects. It is also key for WorldFish researchers themselves to see the larger landscape of what their pilot projects will ultimately feed into, which does ideally require building the foundations for potentially going to scale through initial pilot projects as part of building effective livelihood outcomes if successful scaling up and out is to occur at a later date.

2.7 Participatory Theory of Change: Next Steps

Due to the timing of this consultancy, it was not possible to undertake all the necessary steps required to complete the initial draft SmartFarm TOC presented in this report. In order to achieve all outcomes identified, it is essential that participatory Theory of Change is done properly. This approach is not a "magic bullet" – it is only as good as its implementers, and without due attention to process, it will not result in the kinds of transformational outcomes that it aspires to. It is therefore suggested that the SmartFarm project team undertake the following in partnership with all project stakeholders:

- Review the overall TOC and adjust/add outcomes as necessary;
- Include community outcomes from the remaining two project sites (if additional/different to those already presented);
- Add assumptions for each outcome (i.e. the conditions that must exist if the project is to succeed, but which are outside the direct control of the project);
- Develop indicators for outcomes that extend beyond the existing SmartFarm project and are therefore not included in the M&E framework in Section 3 of this report;
- Identify any additional interventions that will support making progress towards the outcomes generated; and
- Write a narrative for the overall TOC.

2.8 Theory of Change Online Software (TOCO)

The SmartFarm participatory TOC was designed using online software specifically developed by ActKnowledge for Theory of Change. The website address for this software is: *http://toco.actknowledge.org/*

To access the SmartFarm participatory Theory of Change, enter the following details into the web address homepage above:

Username: **smartfarm**
Password: **worldfish**

Please note, the username and password are case sensitive.
Further details on how to use this online resource can be found at the following address:
http://www.theoryofchange.org/toco-software/#1

2.9 Participatory Theory of Change for Funding Proposals

It is highly recommended that the SmartFarm TOC forms the basis of, and is included in, future funding proposals. It offers donors a comprehensive long-term overview of where SmartFarm and AAS ultimately want to get to in regards to adaptation and resilient development, and how they aim to get there. In addition, donor funding architecture is rapidly changing in regards to adaptation. TOC will increasingly be requested. For WorldFish as an institution to understand how to develop a TOC using this report as a first step is therefore valuable.

Section 3: M&E Indicator Framework to Assess SmartFarm Effectiveness

3.1 Background to the SmartFarm M&E Indicator Framework

Following on from the above participatory TOC process, an M&E indicator framework for SmartFarm has been designed based on the approach used in this document. The purpose of the SmartFarm M&E indicator framework is to present priority **outcome indicators** that measure the progress of project effectiveness at and across SmartFarm project sites in strengthening climate livelihood resilience for targeted project participants enabling sustainable adaptation to current and potential future uncertain climate change impacts through agriculture and aquaculture livelihood systems determined through action research. It therefore looks at addressing the question: How effectively is SmartFarm making progress through its action research approach towards realising the long-term goal of strengthening livelihood resilience of climate vulnerable poor farmers in SW Bangladesh to climate and non-climate risks?

As is presented in the participatory SmartFarm TOC above, reaching the long-term goal through effective CBA change pathways requires assessing whether SmartFarm results in building climate livelihood resilience (and therefore reducing vulnerability) for project participants through tangible changes in adaptive capacity, and capacity of relevant local institutions to deliver services and benefits to them that are required for adaptation through an enabling institutional environment. This is necessary, as adaptation does not happen in a vacuum but in an institutionally rich context.

This gives rise to the need for (downstream) **indicators around adaptive capacity and resilience.** Such indicators are difficult to define given the uncertainty surrounding these concepts. However, it is widely agreed that in development deficit situations[9], good development coupled with access to and ability to use information related to climate risks, are prerequisite for adaptation. Therefore progress against basic development indicators and livelihood outcomes in light of climate impacts provides one set of indicators for adaptive capacity. Indicators of awareness and the ability to use climate information in adaptive decision making is another. This also gives rise to the need for (upstream) **indicators of evidence of mainstreaming and capacity building** of the relevant institutions and service providers that are identified by SmartFarm project participants to provide climate risk management and adaptation services.

The approach used here also identifies that in order for SmartFarm to be effective, three interlocking domains need to be affected in each of the above indicators areas. These domains are:

1. Meaningful and locally relevant knowledge (K) about climate change and adaptation science, as well as other non-climate related knowledge bases. The former requires knowledge to be generated locally and merged with that developed by climate change 'experts' in order to design feasible, credible and useful adaptation options.

2. Knowledge is not enough unless people and institutions have the capacity (C) to act on it. This means having the skills, power and ability (including finances) to turn knowledge into practice. This applies in the context of both the individual - in terms of having access to the basic assets, resources and institutions that enable them to adapt to climate variability and change - and to institutions too, which need access to resources and incentives to turn knowledge into action, and the mandate to do this.

3. Supporting knowledge and capacity will lead to changes in **practice** (P). These can be adaptive strategies undertaken by local people, or shifts towards a more integrated, long-term, flexible, strategic and participatory way of development planning both by organisations implementing projects and those relevant local institutions engaged in project processes for the achievement of ultimate outcomes.

[9] In development deficit situations, people do not have access to the basic assets, institutions and services they need to fulfill their basic capabilities. Addressing the development deficit is therefore a first step in enabling people to cope with and manage the additional stresses presented by climate variability and climate change.

Figure 6 below describes the framework developed for SmartFarm outcome indicators that is adapted from emerging frameworks under development at the international level for the M&E of successful adaptation.[10] Supporting the strengthening of livelihood resilience of climate vulnerable poor farmers requires indicators focusing on strengthening their knowledge (K) and capacity (C) to improve their long-term adaptive capacity and resilience in light of changes in climate and other risks. Mainstreaming and capacity building indicators demonstrate local institutions have the knowledge (K), capacity (C) and incentives to provide adaptation services and benefits to the climate vulnerable poor. Together these two components should result in evidence that people (and institutions) actually are adapting to climate change impacts through changing agriculture and aquaculture livelihood practice (P) and behaviours in light of improved adaptive capacity and access to adaptation services:

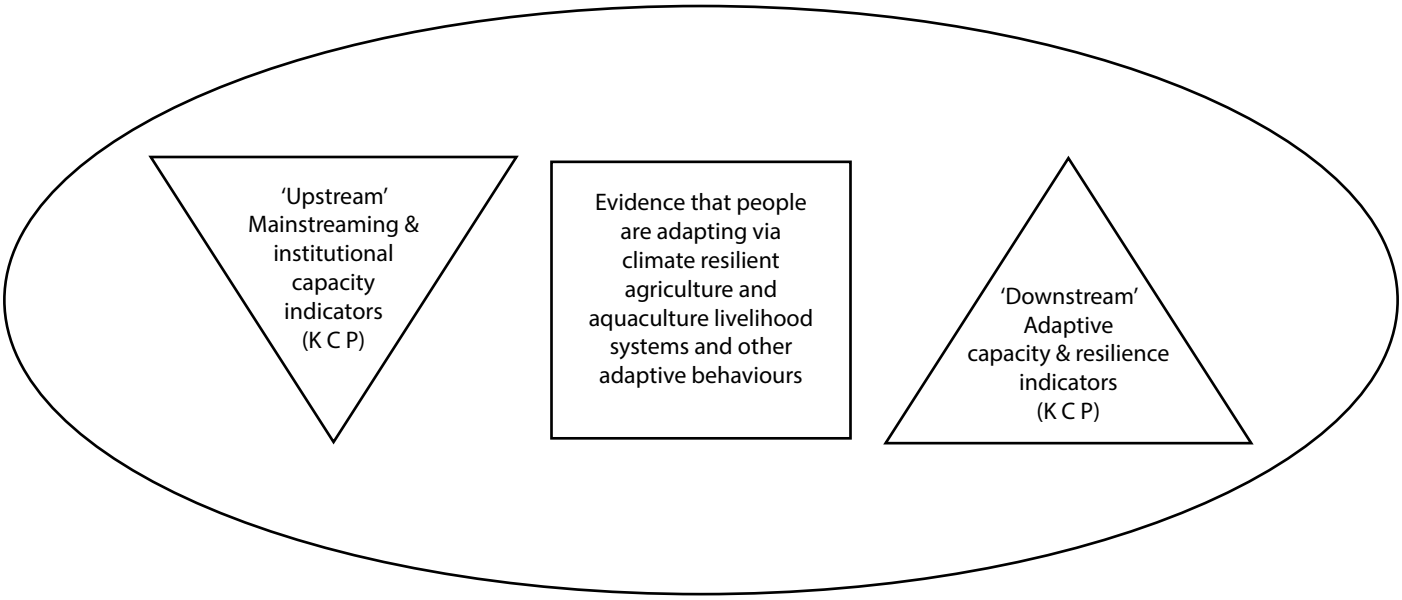


Figure 6: Conceptual framework for SmartFarm outcome indicator areas (adapted from ARCAB 2012; Brookes et al. 2011).

Table 1 below presents priority indicators for the **existing** SmartFarm project in line with the above approach for measuring project effectiveness.

These indicators have been developed based on consultations with male and female community stakeholders engaged in two project sites visited for data collection (Appendix 1); the SmartFarm project team (with potential indicators in the existing project logframe adjusted towards those more tailored to suit revised project needs); insight from the selected approach methodology and literature review findings. Indicators generated in each project site during fieldwork are not presented individually. Indicators are presented together to form an overall M&E indicator framework for SmartFarm. Moreover, where possible, the following indicators have been linked to CCAFS global indicators to ensure continuity across wider WorldFish M&E systems. Details of these linkages are stated in the footnotes section where appropriate in Table 1.

Also, the indicators presented below reflect measurements of change for SmartFarm components focused on CBA action research initiatives on agriculture and aquaculture at household and community level until the end of the existing project cycle in November 2014. Indicators do not therefore reflect the specific research agendas being undertaken by SmartFarm that focus on (i) current weather prediction and forecasting systems; (ii) the principle and potential of sorjan agriculture systems, and (iii) the experience and potential for index-based insurance in Bangladesh.

Similarly, the following SmartFarm M&E indicator framework is "downstream" outcome area indicator focused – i.e. indicators relating to building adaptive capacity and resilience of ultimate project participants in light of climate and non-climate risk factors. This is a result of the current status and focus of the SmartFarm project. It is recommended that increased focus on "upstream" outcome indicators – i.e. indicators relating to building institutional mainstreaming and capacity building to deliver adaptation benefits to ultimate project participants - is adopted during AAS to strengthen effective CBA support.

In addition, the indicators provided below are suggestions to facilitate discussion within the SmartFarm team. They are not an exhaustive list. They can therefore be supplemented/adjusted if required. Similarly, the timing of this consultancy did not allow detailed consultations to be conducted with all stakeholders on the available information sources and tools that can meet the data requirements of the framework. It is suggested therefore that the SmartFarm team review the sources/tools suggested in the SmartFarm outcome M&E plan in Table 2 below, and add to/adjust them if necessary.

Lastly, the following indicators also serve as examples that can be applied to wider WorldFish programs beyond SmartFarm. For indicators to be meaningful at project level, they need to be locally relevant. The indicators presented here have therefore been designed for the SmartFarm context, yet they are also likely to be relevant to other projects based on the overall indicator outcome areas presented through the approach used in this document that is relevant to all contexts. Moreover, these indicators measure outcome level change of key components synergistic with AAS, rather than on specific project activities. The indicators presented here can therefore be selected for other WorldFish projects and programs based on individual initiative goals, and adapted if needed to the local project context in question by WorldFish practitioners engaged in M&E processes.

Table 1: SmartFarm M&E Indicator Framework for Assessing Project Effectiveness in Building Climate Resilience at Project Level

Outcome Area	High level indicators	Sub indicators
'Upstream' indicators: institutional capacity to manage climate risks and deliver adaptation benefits to ultimate project participants (climate vulnerable poor farmers)	Level of knowledge, capacity and practice of identified (local) institutions	This outcome area remains blank based on the current status and focus of the SmartFarm project.
'Downstream' indicators: changes in adaptive capacity and resilience of ultimate project participants (climate vulnerable poor farmers)	Number of people experiencing improvements in adaptive capacity and resilience in light of climate and non-climate risks All indicators to be disaggregated by **gender** in line with WorldFish and CCAFS guidelines	**Overall vulnerability reduction/Improvement in resilience]** Number of people benefitting from SmartFarm to adapt to current and potential future climate change impacts (coverage) Change in people's well-being[11] **[Knowledge]** % of people with an improved (or defined) level of knowledge on climate variability, climate change, vulnerability and adaptation % of people with and level of access to meaningful, regular and updated sources of meaningful scientific and traditional weather and climate information % of project participants with improved (or defined level of) knowledge on locally meaningful non-climate risk information[12] **[Capacity]** (%) of people with utilized skills (to implement climate resilient agriculture/aquaculture initiatives) (%) of people with higher level of access to relevant technology and resources (to implement climate resilient agriculture/ aquaculture initiatives) Evidence of ability to collectively discuss, generate and adapt existing capacity/practices to changing circumstances if required, including women[13] (%) change in income levels[14] (%) change in food security levels (%) change in agriculture production[15] (%) change in agricultural crop diversity (%) change in aquaculture production in ponds[16] and in beel[17] (%) change in fish species diversity

[11] This indicator is taken from TAMD 2013: p20. This is a less resource-intensive and time-intensive method of assessing changes in project participant vulnerability levels as a result of SmartFarm compared to the household survey approach proposed by TAMD. In PWR, community groups are asked to assess the proportions of the community that fall into different categories of `well-being' (e.g. Hargreaves et al., 2007). These categories can be defined to encompass vulnerability, letting the approach yield information on numbers of people experiencing changes in vulnerability over time.

[12] This includes information on new and improved agriculture and aquaculture practices, and any other relevant information identified as important by disaggregated community groups.

[13] This indicator relates to CCAFS global indicator 18: % of technologies under research that have an explicit target of women farmers.

[14] Due to selling excess vegetable and fish production from climate resilient initiatives.

[15] Fieldwork shows project participants wish doubled agricultural production by November 2014. The baseline (as of June 2013) is 1 bigha = 63 decimals.

[16] Fieldwork shows project participants wish 15-20 decimal fish production in ponds by November 2014. The baseline (as of June 2013) is 8-10 decimals.

[17] Fieldwork shows project participants wish 20% increase in beel aquaculture production by November 2014. The baseline (as of June 2013) is 0.

Table 1: SmartFarm M&E Indicator Framework for Assessing Project Effectiveness in Building Climate Resilience at Project Level

		[Practice] % and evidence of people using climate and non-climate related risk information in their decision-making (planning and practice implementation) % of people implementing climate resilient agriculture initiatives[18] (proxy indicators: changes in coping strategies adopted by people compared to baseline % of people implementing climate resilient aquaculture initiatives[19] (proxy indicators: changes in coping strategies adopted by people compared to baseline) % and evidence of climate resilient agriculture/aquaculture practices initiated targeting women project participants[20]
Adaptation environment and context	Tracking of relevant climate and other risks driving ultimate project participant vulnerability	Rainfall levels and patterns Frequency/intensity cyclones Mean temperature levels Fish and vegetable market prices Political (in)stability Salinity levels

[18] Fieldwork shows project participants wish 80% of community to be implementing climate resilient agricultural practices by November 2014. The baseline (as of June 2013) is 50% (mainly FFS members). This indicator relates to CCAFS global indicator 17: No. of technologies/NRM practices under research in CRP (Phase I); CCAFS global indicator 22: No. of technologies/NRM practices field tested (Phase II); and CCAFS global indicator 34: No. of farmers who have applied new technologies or management practices as a result of CPR research.

[19] This indicator relates to CCAFS global indicator 17: No. of technologies/NRM practices under research in CRP (Phase I); CCAFS global indicator 22: No. of technologies/NRM practices field tested (Phase II); and CCAFS global indicator 34: No. of farmers who have applied new technologies or management practices as a result of CPR research.

[20] This indicator relates to CCAFS global indicator 18: % of technologies under research that have an explicit target of women farmers.

3.2 Taking the draft SmartFarm M&E indictor framework forward

The above development of a participatory TOC for SmartFarm and M&E indicator framework that is responsive to the TOC and the existing SmartFarm project forms the substantive focus of the SmartFarm M&E system. The next step focuses on the operationalization of the outcome M&E plan by the SmartFarm Project Manager and SmartField field staff, with support from the WorldFish M&E team. The outcome M&E plan is to highlight:

- The sources of where relevant information can be found;
- How this information is to be collected;
- How often indicators are to be monitored (and verified and reported); and
- Who is responsible for collecting this information.

The SmartFarm outcome M&E plan is presented in Table 2 below. Based on its contents, SmartField staff and WorldFish M&E team are to collaboratively discuss and design HH surveys and focus group discussion questions as necessary in accordance with the outcome M&E plan.

Table 2: SmartFarm Outcome M&E Plan

Indicator	Indicator definition / reasoning	Data collection source	Data collection method / tool	Frequency	Responsibility
Overall vulnerability reduction/improvement in resilience					
Number of people benefitting from SmartFarm to adapt to current and potential future climate change impacts	Number of project participants receiving SmartFarm support.	Project documentation: Baseline, project progress reports and final evaluation survey	Questionnaire based survey	Now; In 6 months; At end of project.	SmartFarm
Change in people's well-being	Measuring change in project participant's vulnerability levels as a result of SmartFarm. This supplements the coverage indicator above which by itself does not yield any information on how well SmartFarm support has achieved intended results. This closely links to the capacity indicators below on improved/secure development outcomes in light of climate risk, which may conceptualize community perceptions of well-being in itself. SmartFarm team may decide therefore that this indicator is not necessary. It is nevertheless added here to provide SmartFarm with indicator options.	Project participants	Participatory well-being ranking (PWR). See reference Hargreaves et al. 2007. PWR categories to include vulnerability defined according to SmartFarm context, i.e. relative to agriculture/ aquaculture outcomes.	Now; In 6 months; At end of project.	SmartFarm
KNOWLEDGE					
% of people with an improved (or defined) level of knowledge on climate variability, climate change, vulnerability and adaptation	Measurement of project participant knowledge levels in these areas is needed to support (i) project participant understanding of the need to change existing practices; and (ii) the design of locally-relevant and meaningful climate resilient agriculture/aquaculture livelihood options/ strategies.	Project participants	HH survey / Focus group discussion	Now; In 6 months; At end of project.	SmartFarm
% of people with and level of access to regular and updated sources of meaningful scientific and traditional weather and climate information	Adequate access to climate related information is required to build adaptive capacity as a prerequisite for adaptation that supports building the knowledge-base of project participants on climate risk.	Project participants	HH survey / Focus group discussion	Now; In 6 months; At end of project.	SmartFarm
% of people with improved (or defined level of) knowledge on locally meaningful non-climate risk information	It is not only climate information that is required for credible and feasible adaptation strategies. Relevant non-climate information is also needed, such as information on new and improved agriculture and aquaculture practices, and any other relevant information identified as important by disaggregated community groups, into which climate information can be integrated to build climate resilience.	Project participants	HH survey / Focus group discussion	Now; In 6 months; At end of project.	SmartFarm

CAPACITY					
% of people with utilized skills (to implement climate resilient agriculture/aquaculture initiatives)	Project participants possess relevant skills that combine with the necessary knowledge-base stated above for improved adaptive capacity.	Project participants	HH survey / Focus group discussion	Now; In 6 months; At end of project.	SmartFarm
% of people with better level of access to relevant technology and resources (to implement climate resilient agriculture/ aquaculture initiatives)	Project participants have adequate access to needed technology and resources that together with a strong knowledge-base and relevant skills will enable implementation of climate resilient adaptation options.	Project participants	HH survey / Focus group discussion	Now; In 6 months; At end of project.	SmartFarm
Evidence of ability to collectively discuss, generate and adapt existing capacity/ practices to changing circumstances if required, including women	This refers to the potential for innovation and needed capacity ability in light of local changing climate contexts. This includes access to spaces to discuss, share and generate knowledge and skills to inform climate resilient adaptive practices. Similarly, evidence of participatory and proactive learning mechanisms to inform action/practice over time, including learning-by-doing approaches.	Project participants	HH survey / Focus group discussion	Now; In 6 months; At end of project.	SmartFarm
(%) change in income levels	Change in income levels as a result of SmartFarm. This improvement/securing of development outcomes in light of climate risk contributes to assessing changing vulnerability levels due to SmartFarm project support.	Project participants	HH survey	Now; In 6 months; At end of project.	SmartFarm
(%) change in food security levels	The same reasoning provided above applies here. The definition of food security here aligns with that already established by WorldFish (for example, HH level of access to diverse food sources throughout the year and/or that HHs able to meet basic food and non-food needs through the year)	Project participants	HH survey / methods already utilised by WorldFish	Now; In 6 months; At end of project.	SmartFarm
(%) change in agriculture production	The same reasoning provided above applies here.	Project participants	HH survey / methods already utilized by WorldFish	Now; In 6 months; At end of project.	SmartFarm
(%) change in agricultural crop diversity	The same reasoning provided above applies here.	Project participants	HH survey / methods already utilized by WorldFish	Now; In 6 months; At end of project.	SmartFarm
(%) change in aquaculture production in ponds	The same reasoning provided above applies here.	Project participants	HH survey / methods already utilized by WorldFish	Now; In 6 months; At end of project.	SmartFarm
(%) change in aquaculture production in beel	The same reasoning provided above applies here.	Project participants	HH survey / methods already utilized by WorldFish	Now; In 6 months; At end of project.	SmartFarm
(%) change in fish species diversity	The same reasoning provided above applies here.	Project participants	HH survey / methods already utilized by WorldFish	Now; In 6 months; At end of project.	SmartFarm

PRACTICE					
% and evidence of people using climate and non-climate related risk information in their decision-making (planning and practice implementation)	This is to assess ability of project participants to mainstream climate information into their planning and decision-making processes for building climate resilience. This also includes project participant awareness and ability to plan long-term in light of climate risk.	Project participants	HH survey / Focus group discussion	Now; In 6 months; At end of project.	SmartFarm
% of people implementing climate resilient agriculture initiatives [21] (proxy indicators: changes in coping strategies adopted by people compared to baseline)	This is the result of the above knowledge and capacity indicators, where climate resilient livelihood strategies are undertaken by project participants.	Project participants	HH survey / Focus group discussion	Now; At end of project.	SmartFarm
% of people implementing climate resilient aquaculture initiatives[22] (proxy indicators: changes in coping strategies adopted by people compared to baseline)	The same reasoning provided above applies here.	Project participants	HH survey / Focus group discussion	Now; At end of project.	SmartFarm
% and evidence of climate resilient agriculture/aquaculture practices initiated targeting women	All of the above indicators are to disaggregated by gender in accordance with WorldFish guidelines, yet this indicator is identified to reinforce this outcome.	Project participants	HH survey / Focus group discussion	Now; In 6 months; At end of project.	SmartFarm

TRACKING OF RELEVANT CLIMATE AND OTHER RISKS DRIVING ULTIMATE PROJECT PARTICIPANT VULNERABILITY					
Rainfall levels and patterns	This indicator and those below are the result of stated local climate and non-climate stressors impacting on project outcomes as perceived by project participants themselves.	Project participants/ weather data/ Ministry of Environment	IWM methods / Rainfall calendars (CARE PMERL approach) / local weather station information review	Now; At end of project.	Project participants (IWM methods and rainfall calendars) and SmartFarm project team

[21] Fieldwork shows project participants wish 80% of community to be implementing climate resilient agricultural practices by November 2014. The baseline (as of June 2013) is 50% (mainly FFS members). This indicator relates to CCAFS global indicator 17: No. of technologies/NRM practices under research in CRP (Phase I); CCAFS global indicator 22: No. of technologies/NRM practices field tested (Phase II); and CCAFS global indicator 34: No. of farmers who have applied new technologies or management practices as a result of CPR research.

[22] This indicator relates to CCAFS global indicator 17: No. of technologies/NRM practices under research in CRP (Phase I); CCAFS global indicator 22: No. of technologies/NRM practices field tested (Phase II); and CCAFS global indicator 34: No. of farmers who have applied new technologies or management practices as a result of CPR research.

3.3 Mainstreaming Indicators for WorldFish

Following on from the discussion in Section 2 above on mainstreaming climate change resilience and adaptation into WorldFish development programming, this section of the document provides an entry point for this integration to occur in addition to the information already provided through the SmartFarm M&E strategy and indicator framework.

The conceptual framework of SmartFarm outcome indicator areas presented in figure 6 above also provides a framework of outcome indicator areas for WorldFish at large based on its relevance for organizational goals. The approach for indicator identification used above is therefore useful here, as it provides example indicators that are to be measured in light of climate change and other risks.

Indicators presented in Table 3 below can be incorporated into project cycles before projects begin and at the stage of M&E indicator identification. The objective is not to vastly increase the quantity of indicators used, but to help capture climate resilience and adaptation information to support project and program sustainability. Moreover, for mainstreaming indicators to be meaningful at project level, they need to be locally-relevant, as all project indicators do. The indicators provided below are therefore more generic 'sample indicators' that may be used as they are presented in some project and program contexts, while other contexts may require indicators to be adapted in order for them to more closely align with individual project or program goals.

Table 3: Example climate change adaptation mainstreaming indicators

Outcome Area	High level indicators	Sub indicators
Upstream indicators: institutional capacity to manage climate risks and deliver adaptation benefits to ultimate project participants (climate vulnerable poor farmers)	Level of knowledge, capacity and practice of identified (local) institutions	**[Knowledge]** % (or proportion of) local relevant institutional key agents of change with a defined level of knowledge on climate variability/climate change/vulnerability and adaptation % (or proportion of) local relevant institutional key agents of change identified as climate vulnerable attending climate sensitization workshops Evidence of knowledge of needs of and responsibility towards climate vulnerable poor farmers/communities by institutional key agents of change **[Capacity]** No. of climate vulnerable poor included in relevant decision-making/budgeting forums and evidence of active participation of most climate vulnerable groups Evidence of functional institutions present and operational[23] **[Practice]** Evidence of climate vulnerable poor adaptation priorities reflected in local level plans % or number of relevant local institutional planning and decision-making processes incorporating climate vulnerable poor (livelihood) needs % budget (re)allocated in light of climate vulnerable poor livelihood adaptation planning and priorities
'Downstream' indicators: changes in adaptive capacity and resilience of ultimate project participants (climate vulnerable poor farmers)	Number of people experiencing improvements in adaptive capacity and resilience in light of climate and non-climate risks All indicators to be disaggregated by **gender** in line with WorldFish and CCAFS guidelines	**[Knowledge]** % of people with an improved (or defined) level of knowledge on climate variability, climate change, vulnerability and adaptation % of people with and level of access to meaningful, regular and updated sources of meaningful scientific and traditional weather and climate information Evidence of effective lesson learning shared from target to non-target project participants[24] **[Capacity]** (%) changes in relevant livelihood/development outcomes (e.g. food security in sensitive times of the year) Changes in value of relevant assets Evidence of maintained ecosystem services **[Practice]** Evidence of changing attitudes to risk taking and long-term planning for uncertainty under climate change % of people using climate information in decision making Level of change in project participant ability to manage climate risks measured from a departure from pre-intervention coping strategies
Adaptation environment and context	Tracking of relevant climate and other risks driving ultimate project participant vulnerability	E.g. Land disputes E.g. Groundwater levels

[23] This indicator is included here based on the premise that local relevant institutions first have to be present and operational before climate risk management functions can be integrated into institutional systems.

[24] This indicator supports evidence of effective resilience building through scaling out of effective processes and practice so a wider number of people can benefit from local evidence of 'what works.'

Section 4: Conclusion and recommendations

This report sets out an M&E framework and strategy for WorldFish Bangladesh's SmartFarm project, and links this approach to wider WorldFish institutional development programming and planning systems to facilitate a harmonized approach to climate change adaptation.

Based on the contents of this report and fieldwork undertaken, recommendations provided below aim to support WorldFish and SmartFarm in making further progress towards delivering effective CBA, and development as part of the process towards this goal, for the climate vulnerable poor farmers and communities they work with.

1. Complete the draft SmartFarm Theory of Change in collaboration with key stakeholders across scales. TOC is the backbone of CBA programming and M&E design. The current draft is therefore to be revised and 'finalized' (as much as it can be) in accordance with present knowledge levels of delivering effective CBA support. As a living road map for future programming, it is to be adapted in response to changing contexts and the generation of potential new knowledge of what does and does not 'work' through project reflection and learning from the wider community of CBA practice. This is likely to ensure that flexible approaches to planning are in place that can respond to changing needs and incorporate a range of knowledge bases, especially that generated by project participants. Moreover, in order for climate vulnerable poor groups to be driving adaptation planning and project design, the TOC is to be completed in close collaboration with project participants to support progress towards long-term CBA goals.

2. More regular and systematic climate change training is needed at local level for all stakeholders engaged in SmartFarm. This knowledge is key to informing the design of feasible, credible and useful adaptation options. However, leveraging changes in knowledge and capacity in order to facilitate sustainable adaptation practice cannot be produced through a limited number of training sessions. More targeted climate change training is therefore needed at local level to support communities to develop more forward-thinking climate change foresight that incorporates a longer term time horizon. Moreover, it is recommended that training given is verified through appropriate assessment mechanisms. Understanding that knowledge has been successfully imparted is important. This will facilitate the progression of stakeholders to undertake higher levels of training as their capacity increases over time.

3. Undertake steps that build on the identification of relevant scientific institutions providing improved scientific climate information and ensure relevant institutions are capacitated to act as boundary organisations translating scientific information into an accessible format and language that can be used to inform adaptive practice by project participants. This is required to generate new knowledge on adaptation and future climate change that forms a core pathway in the SmartFarm TOC. Although relying on scientific expertise alone is not enough, it is needed in order for it to be blended with locally-generated knowledge from the climate vulnerable poor about past climate trends and the interaction between climate impacts, vulnerability and adaptation. It is understood that SmartFarm is already working with IWM in this regard for project participant training on collection of rainwater levels, along with other key national scientific organisations. SmartFarm and relevant institutions need to ensure that scientific information is translated into a practically beneficial and accessible language and format catering to the needs of each stakeholder group engaged in the project.

4. Empower climate vulnerable poor groups with tools to collect climate-related information for themselves. This recommendation will further support the generation of local climate knowledge. It is not just "what" is being done that is important, but "why" and "with what knowledge" that is key. As CBA is a community-driven process that is done by communities themselves, this suggestion will provide new insights into current and potential future risks that will force project participants to look beyond past experience and to consider the limitations of past adaptive solutions. This may include initiating community weather stations that track changes in climate over time. As above, it is understood that SmartFarm is already working with IWM for project participant training on collection of rainwater levels, yet this basis ideally needs to be strengthened to form a more long-term sustainable community climate information collection process.

5. Explore how to integrate effective participatory M&E at community level into SmartFarm and AAS longer term CBA programming design. Actively involving communities in monitoring and evaluation is key to empowerment and building resilience for CBA. A bottom-up approach to M&E will support building sustainable knowledge generation systems, in which climate vulnerable poor groups can assess progress in building adaptive capacity, assess changing risk context and their impacts, as well as ultimately assessing the performance and delivery of service providers, including WorldFish. Building the capacity of existing FFS groups already operational within each project site to undertake this function may be plausible.

6. Use the SmartFarm TOC, ARCAB TOC and CBA Resilience Scale to support adjusting existing WorldFish planning and management processes towards a more integrated and long-term operational paradigm that mainstreams adaptation into ongoing and future development decision-making. This is recommended to support WorldFish in maximising the benefits from their ongoing and future development investments, ensuring that they are not only climate resilient, but that they also build longer term climate resilience for project participants through a strategic transformative approach.

7. Planning for scaling up and scaling out to be considered at the outset of future pilot project planning design. As WorldFish is a research center that focuses on action research to identify effective agriculture and aquaculture practices for climate vulnerable poor farmers, taking account of scaling up and out of effective practices established is key to their work for the sustainability of pilot projects. To support this process, important questions to be considered at the outset of future project planning design are: What if this pilot project works? What then? (Linn 2012) An assessment of key "drivers" [25] and enabling conditions to be created, including political, policy and partnership "spaces"[26] that ensure that if the pilot project is successful, it can move forwards along planned scaling up and out pathways, is vital from the outset (Hartmann and Linn 2008). This recommendation is included here in light of institutional desire to potentially scale up and out effective SmartFarm practice under AAS.

8. Implement WorldFish's alternative to baselines for future investments to ensure the evidence base exists to support meaningful evaluation. It is understood that WorldFish does not use baselines in their projects and that an alternative approach is currently under design for future implementation. This becomes even more essential in an adaptation context, as good baseline data (or an effective alternative) is important for tracking adaptation and development trends that is often missing from evaluations of development outcomes (TAMD 2013). This will facilitate WorldFish's ability to understand if and how their interventions are contributing to adaptation.

9. Compliment bottom-up vulnerability assessments with a review of existing information on current vulnerability, climate risk, and current adaptation measures from previous studies, expert scientific opinion, and policy context for baseline setting. It is recommended that the WorldFish baseline equivalent includes a thorough participatory climate change risk and vulnerability assessment with different project participant groups (men, women, most vulnerable) in each project site. If projects and programs are to reduce vulnerability/increase resilience of its ultimate project participants, this information is key. It is therefore important to ensure that the assessment undertaken provides adequate information on risks and vulnerabilities to establish a baseline equivalent with. If it does not, then additional assessment will be needed. Similarly, it is important to ensure that the assessment identifies key enabling factors and barriers to reaching project objectives. Please note, the process described here will need to be more comprehensive than the approach used in this document. The approach used in this report was designed based on time availability. To supplement community information provided, it is recommended that a review and synthesis of existing information on current vulnerability, climate risk, and current adaptation measures based on previous studies, expert opinion, and policy context is undertaken. This will merge scientific information with local knowledge. If available, a description of adaptation policies and measures that influence the ability of climate vulnerable farmers to successfully cope with climate variability is also suggested. Both these sets of information are required when setting a baseline/baseline equivalent for adaptation (WRI/GIZ 2011).

[25] Drivers" are the forces pushing the scaling up process forward.

[26] "Spaces" are the opportunities that can be created, or potential obstacles that need to be removed to open up the space for an intervention to grow.

10. Look at "upstream" outcome areas in SmartFarm extension phase through AAS. This is required in order to move beyond short-term projectized approaches to planning towards integrated approaches that engage with and build the capacity of local to national institutions. Developing SmartFarm's draft Theory of Change contributes to supporting institutional thinking more on a long-term time horizon in regards to delivering effective CBA. Building strong institutional processes is an important factor if CBA is to be scaled up, scaled out, and sustainable over time. It is therefore recommended that "upstream" TOC outcomes and indicators are developed in collaboration with relevant local institutions for the improved delivery of adaptation benefits to ultimate project participants.

11. Undertake participatory institutional service provider analysis in project sites. This also links to the recommendation above. It is suggested that an institutional/service provider analysis is needed in order for AAS/WorldFish to understand which institutions (both formal/informal) are important to project participants for the delivery of adaptation benefits. This information will inform which institutions should be engaged in future projects and programs. It is useful to understand the relations between communities and key actors that influence their adaptive capacity, and how these relations can be influenced. This initial analysis therefore ideally needs to form part of the project baseline equivalent so subsequent analysis can be compared against it. Alternatively, this analysis of the local institutional context can be undertaken as a first step in project planning. To support this analysis, it is recommended that the 'Service Provider Analysis' tool in the CARE/IIED PMERL manual (Tool 2) is explored. This supports the elicitation of information that project participants identify as important for the specific provision of adaptation services and benefits now, and in the future, which is key when looking through a climate change lens.

12. If not already in place, devise an effective knowledge management system. It is recommended that WorldFish design and implement an effective knowledge management process. This will support the availability of lessons learnt from M&E information generated from SmartFarm and future WorldFish/ ASS projects and programs beyond the project to other organizational and partner stakeholders to foster learning and improve programmatic efforts in building climate resilience.

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Appendix 1

Details of fieldwork undertaken for the development of the SmartFarm M&E framework and strategy in Bangladesh

Mixed methods of data collection were employed during fieldwork at two SmartFarm project sites visited in southwestern Bangladesh. These sites were:

- Jagannatpur Village, Jhalokhati District, Rajapur Upazila, Suktagarhi Union (non-saline area)
- Dumuria village, Satkhira District, Shyamnagar Upazila, Gabura Union (high saline area)

Research largely comprised of qualitative approaches, as well as primary and secondary data sources. Primary data was collected as a result of fieldwork undertaken by the author of this report, Lucy Faulkner, and SmartFarm staff from June 11th to June 22nd 2013. Data collection methods comprised of focus group discussions (FGDs), participatory Risk and Vulnerability Assessment, participant observation, field notes, and participatory TOC and indicator development. Questions asked were framed using language and terms understood by project participants. Where possible, research validity was strengthened through the triangulation of data sources. In addition, secondary data sources were collated during fieldwork to support information required for the development of this study. This consisted of information from SmartFarm project documents, AAS TOC and IDOs, and the CCFAS global indicator framework.

For a complete list of stakeholder details and fieldwork locations, please see below:

1. Jagannatpur Village, Jhalokhati District, Rajapur Upazila, Suktagarhi Union (13 June 2013)
(i) Focus group discussion conducted with female project participants for Risk and Vulnerability Assessment:

No.	Participant name	Participant age	Participant livelihood
1	Khaleda	26	Housewife / Ring owner
2	Kanika	25	Housewife / Ring owner
3	Safadi	40	Housewife / FFS
4	Juthiska	30	Housewife / Ring owner
5	Alo	35	Housewife / Ring owner
6	Aroti	30	Housewife / FFS
7	Doli	16	Student / FFS
8	Biva	50	Housewife / FFS
9	Shandema	40	Housewife / FFS

(ii) Focus group discussion conducted with male project participants for Risk and Vulnerability Assessment:

No.	Participant name	Participant age	Participant livelihood
1	Golam Maula	30	Labourer / FFS
2	Khainul	22	Student / Ring owner
3	Mohammad Hasib	45	Farmer / FFS
4	Mahomud	38	Farmer / Ring owner
5	Abdur Sukkun Maji	60	Farmer / Ring owner / FFS
6	Shoalom	45	Farmer / FFS
7	Anower	40	Farmer / FFS
8	Mabarak	55	Farmer / Ring owner / FFS
9	Habib Fakir	55	Farmer / Ring owner / FFS
10	Liyakal	40	Farmer / Ring owner / FFS
11	Maulad	40	Farmer / FFS

2. Jagannatpur Village, Jhalokhati District, Rajapur Upazila, Suktagarhi Union (14 and 15 June 2013)
(i) Focus group discussion conducted with female project participants for Theory of Change development:

Project participant list is the same as above.

(ii) Focus group discussion conducted with male participants for Theory of Change development:

Project participant list is the same as above.

3. Jagannatpur Village, Jhalokhati District, Rajapur Upazila, Suktagarhi Union (16 June 2013)
(i) Focus group discussion conducted with female project participants for indicator development:

Project participant list is the same as above.

(ii) Focus group discussion conducted with male participants for indicator development:

Project participant list is the same as above.

4. Dumuria village, Satkhira District, Shyamnagar Upazila, Gabura Union (18 June 2013)
(i) Focus group discussion conducted with female project participants for Risk and Vulnerability Assessment:
(ii) Focus group discussion conducted with male project participants for Risk and Vulnerability Assessment:

No.	Participant name	Participant age	Participant livelihood
1	Mamoni Khatum	23	Housewife / Tailor
2	Momotaz Akter	30	Housewife / Vegetable gardening
3	Chobironnessa	30	Housewife / Vegetable gardening
4	Meherumnessa	42	Housewife / Farmer / Vegetable gardening
5	Amena Khatun	27	Housewife / Tailor
6	Anowra	40	Housewife / Vegetable gardening
7	Nazma Khatun	30	Housewife
8	Gulneher	50	Housewife
9	Afroza Khatun	27	Housewife
10	Sarifa Khatun	30	Housewife
11	Pervin Nahar	28	Housewife
12	Achiya Khatum	40	Housewife
13	Jahanara	45	Housewife
14	Sufia Begum	45	Housewife
15	Nurennahar	27	Housewife
16	Rokea Begum	27	Housewife
17	Hasna Vanu	30	Housewife
18	Sahera Khatur	70	Housewife

(ii) Focus group discussion conducted with male project participants for Risk and Vulnerability Assessment:

No.	Participant name	Participant age	Participant livelihood
1	Jahirul Islam	42	Farmer / Business
2	Saheb Ali	35	Farmer / Shopkeeper
3	Seher Ali	50	Farmer / Day labourer
4	Kona Morol	70	Farmer
5	Hobi Morol	50	Farmer / Day labourer
6	Abu-Taleb Gazi	60	Farmer / Day labourer
7	Atiwer Gazi	45	Farmer
8	Sowkot Gazi	65	Farmer
9	Nazrul Gazi	50	Farmer
10	Baser Gazi	60	Farmer
11	Harun Gazi	44	Farmer

5. Dumuria village, Satkhira District, Shyamnagar Upazila, Gabura Union (19 and 20 June 2013)
(i) Focus group discussion conducted with female project participants for Theory of Change development:

Project participant list is the same as above.

(ii) Focus group discussion conducted with male participants for Theory of Change development:

Project participant list is the same as above.

6. Dumuria village, Satkhira District, Shyamnagar Upazila, Gabura Union (21 June 2013)
(i) Focus group discussion conducted with female project participants for indicator development:

Project participant list is the same as above.

(ii) Focus group discussion conducted with male participants for indicator development:

Project participant list is the same as above.

Appendix 2

Fieldwork findings: Risk and Vulnerability Assessments

The results of the risk and vulnerability assessments undertaken in each project site are presented below.

1. Women, Jagannathpur Village, Jhalokhati District, 13 June 2013

Risks / Hazards / Vulnerability (in order of priority)	Intensity of Risks / Hazards / Vulnerability (ranked from 1-5 with 1 refering to little intensity and 5 the most)	Frequency of Risks / Hazards / Vulnerability (ranked from 1-5 with 1 refering to limited occurance and 5 to 12 months a year)	Impact of hazard	Who is Most Vulnerable to Risks / Hazards / Vulnerability?	Current Coping Strategy Undertaken
AGRICULTURE:					
Flooding	5	1	Paddy crops destroyed leading to lack of harvest and income	Women (as men are given all HH food sources)	Buy food at the market; bamboo net/ fence; raised beds for vegetable cultivation; vertical agriculture
Water scarcity	5	1	Vegetable production diminished except for potato and rice due to dry soil conditions	Men (who try to cultivate vegetables)	Mulching; collect water from village ponds and ponds near village
Waterlogging	4	3	Vegetable production diminished except for rice	Men and women	Vertical agriculture; floating beds on ponds
Forest cover	3	5	Lack of sunlight for plants; lack of rain able to reach plants; reduced plant growth	Women	Grow turmeric and sweet potato in shaded conditions; cut down tree branches
Lack of access to quality seeds	2	3	Buy seeds at the local market at high prices; quality seeds not available to buy	Men and women	Preserve 20% of paddy and vegetable seeds

AQUACULTURE:					
Pond inundation	3	1	Fish escape	Men and women	Use nets around ponds
Fish disease	3	1	Fish mortality; reduced nutrition security; reduced income as lack of fish to sell at the market	Men, women and children	Use medicine for live fish; dispose of dead fish from ponds
Lack of technical fish management/ production knowledge	2	4	Lack of fish cultivation	Men and women	Ask Upazila (UZ) Fisheries Department for information on what to feed fish/fish species to grow etc; collect information from neighbouring HHs

2. Men, Jagannathpur Village, Jhalokhati District, 13 June 2013

Risks / Hazards / Vulnerability (in order of priority)	Intensity of Risks / Hazards / Vulnerability (ranked from 1-5 with 1 refering to little intensity and 5 the most)	Frequency of Risks / Hazards / Vulnerability (ranked from 1-5 with 1 refering to limited occurance and 5 to 12 months a year)	Impact of hazard	Who is Most Vulnerable to Risks / Hazards / Vulnerability?	Current Coping Strategy Undertaken
AGRICULTURE:					
Flooding	5	3	Paddy and vegetable crops destroyed; trees broken	Men	Raised beds for vegetable cultivation; bamboo net/fence; floating gardens; vertical agriculture
Plant disease	4	5	Reduced production levels leading to reduced income; tree/ plant mortality	Men (earning source for HH)	Integrated pest management training for UZ Agriculture Office; use of local medicine
Water scarcity	3	1	Vegetables/trees damaged; reduced vegetable/rice production	Men and women	Fertilizer use; collect water from HH ponds
Fog (during winter)	2	1	Weak vegetable growth leading to reduced production	Men and women	Irrigation; fertilizer use
Poor transportation links to market value chains	2	5	Vegetables damaged during transportation leading to loss of income	Men and women	Walk to local market with vegetables on head (rather than main market)
Lack of access to quality seeds	5	5	Low production	Men and women	Buy cheap seeds (30%); preserve 20% of paddy and vegetable seeds

Lack of technical knowledge for appropriate fertilizer use	2	5	poor fertilizer use: under application causes limited plant growth; over application causes plants to die	Men and women	Contact UZ Agriculture Office but receive no support
Lack of correct machinery	2	5	Untimely harvest; reduced production	Men and women	Undertake harvest manually; communicate with machine owners for possible rent

AQUACULTURE:					
Flooding	5	3	Fish escape	Men and women	Use fencing around ponds; raise ponds to higher ground
Lack of quality fingerlings	5	2	Slow fish growth; reduced production leading to reduced income	Men and women	Contact UZ Fisheries Office but receive no support
Lack of fish feed	3	5	Reduced fish growth	Men and women	Increased use of compost for fingerling feed
Lack of technical knowledge on fish culture	5	1	High stocking density leading to reduced fish growth, fish production and income streams	Men and women	None
Heat	3	2	Fish mortality	Men and women	Fish rings (from SmartFarm)
Use of tractors	2	1	Fish mortality	Men and women	Fish rings (from SmartFarm) providing protection
Use of pesticides in paddy fields	2	2	Fingerling mortality	Men and women	None
Fish disease (natural fish)	1	1	Fish mortality leading to reduced HH nutrition	Men and women	None

3. Women, Dumuria Village, Satkhira District, 18 June 2013

Risks / Hazards / Vulnerability (in order of priority)	Intensity of Risks / Hazards / Vulnerability (ranked from 1-5 with 1 refering to little intensity and 5 the most)	Frequency of Risks / Hazards / Vulnerability (ranked from 1-5 with 1 refering to limited occurance and 5 to 12 months a year)	Impact of hazard	Who is Most Vulnerable to Risks / Hazards / Vulnerability?	Current Coping Strategy Undertaken
AGRICULTURE:					
Lack of fresh water for irrigation	5	4	Unable to produce vegetables and paddy for 5 months a year Unable to raise cattle/ livestock due to lack of paddy/grass	All farmers that depend on agriculture – men and women	Rainwater harvesting in existing ponds (but insufficient to meet HH needs); dig ponds for HH agriculture use; cultivate rice in the rainy season only; raise one cow only (rather than 2-3); buy straw for cattle feed
Soil salinity	5	3	Low seed germination; low rate of crop productivity; crop variety decreased	All farmers that depend on agriculture – men and women	Raise cultivation land; vertical agriculture; pit cropping; mulching; use saline-tolerant paddy and vegetable seeds (with NGO support); use fertilizer bought in market to reduce salinity

Risk of embankment breakage due to cyclonic and storm episodes	5	2	Crop damage; saline water ingress in crop fields resulting in long-term reductions in crop cultivation; stored grain and seeds damaged; cost of crop production increases three-fold; increase in insects in field (due to salinity rendering pesticides ineffective)	All community members	Use different fertilizer that works; request Union Parishad (UP) to drain saline water from land; community make new embankment with UP support
Drought	4	1	Unable to cultivate crops/vegetables; increased salinity; cattle/ livestock/ducks die	All community members	Limited no. of HHs collect water from distant locations (3km away)
Lack of income to invest in agriculture	3	2	Unable to buy timely agriculture inputs (seeds, fertilizer etc); unable to secure labor support for land cultivation; unable to undertake land tilling; lack of transportation to go to market; unable to protect homesteads with fencing to stop threat of goats eating vegetables; unable to invest in goats/ducks; unable to feed goats/ ducks if owned	Poorest community members	Microcredit and other input support from NGOs; offer food for work to get labor to till land; sell grain in local market at reduced prices.

AQUACULTURE:					
Low pond depth in dry season (evaporation from heat)	4	2	High salinity in ponds; high pond water temperature leading to fish mortality; increased fish disease	Pond owners and their families	Create shaded ponds; cultivate fast-growing fish species for 6 months a year; add canal water to raise pond water levels
Fish disease in gheers all year round (shrimp farms)	3	1	Increased fish mortality; water polluted with disease	Gheer owners	Dispose of heavily diseased fish; sell mildly diseased fish in the market; till pond bases to remove gases causing fish disease (cultural perception); put river water in gheer farms during high tide
Salinity increase in canals and ponds	3	2	Fresh water fish species mortality; unable to use pond water for HH activities; low binding capacity of clay soil leading to pond dyke erosion	Pond owners	Repair pond dykes with new mud; drain pond and refill with rain water; stock saline fish species
Flooding	2	1	Fish escape from ponds; pond dikes break; waste materials enter ponds causing pollution and fish mortality	Pond owners	Protect pond dykes with nets; increase height of pond dikes before rainy season to prevent overflow; catch all fish cultivated and sell at the market when waste materials enter ponds
Lack of income/capital	3	1	Unable to undertake any aquaculture	Pond owners	Microcredit from NGOs; sell post-larva (PL) shrimp seeds

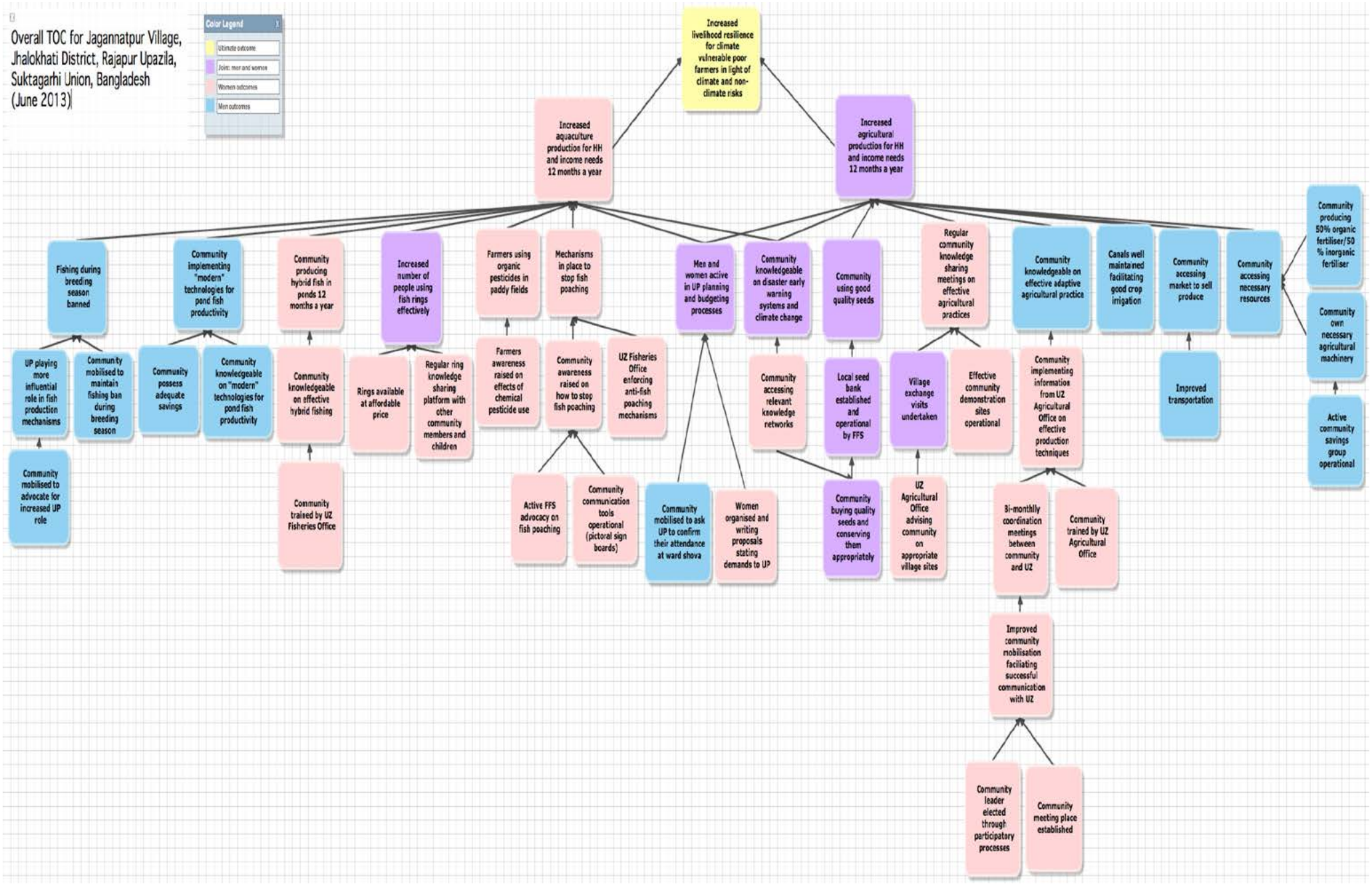
4. Women, Dumuria Village, Satkhira District, 18 June 2013

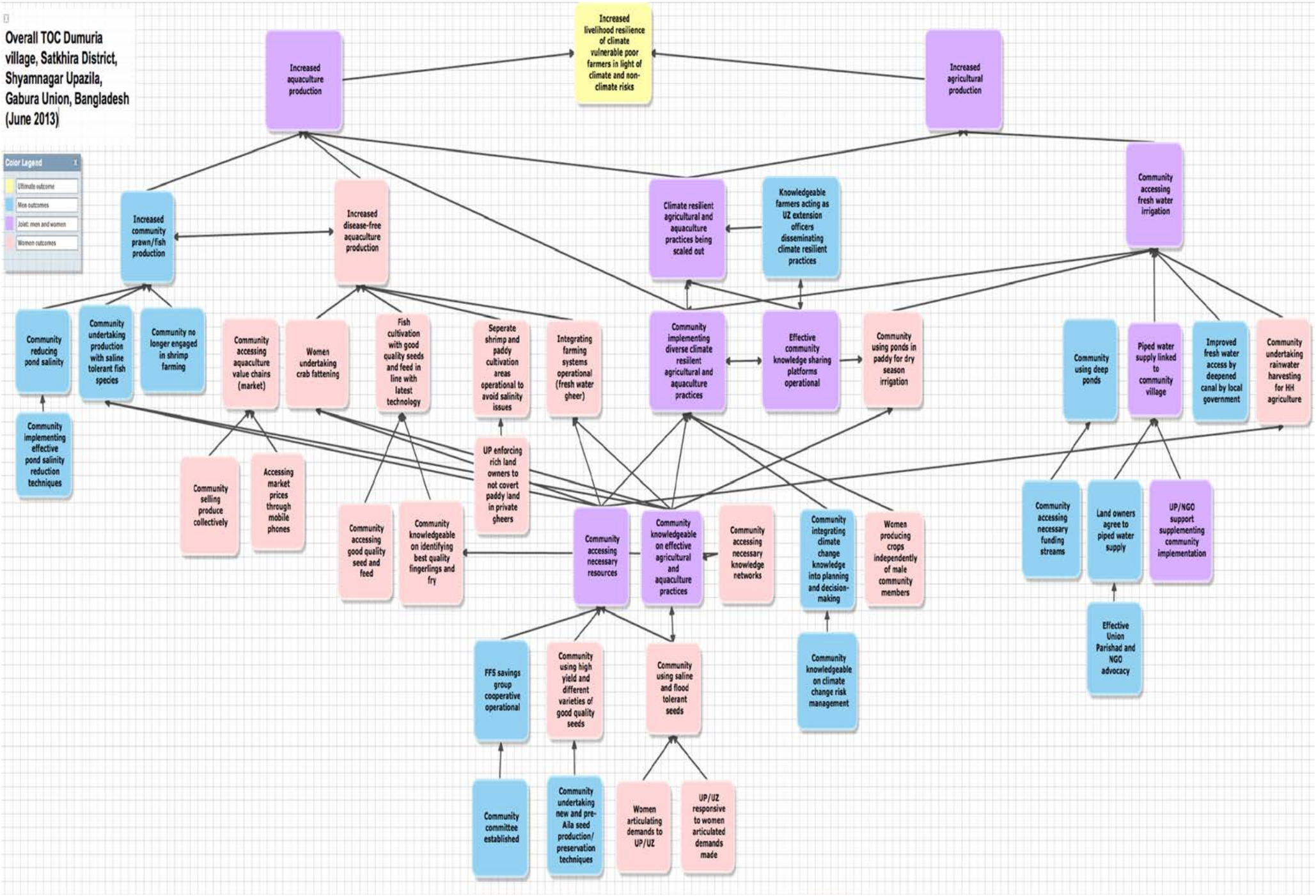
Risks / Hazards / Vulnerability (in order of priority)	Intensity of Risks / Hazards / Vulnerability (ranked from 1-5 with 1 refering to little intensity and 5 the most)	Frequency of Risks / Hazards / Vulnerability (ranked from 1-5 with 1 refering to limited occurance and 5 to 12 months a year)	Impact of hazard	Who is Most Vulnerable to Risks / Hazards / Vulnerability?	Current Coping Strategy Undertaken
AGRICULTURE:					
Lack of fresh water for irrigation	5	3	Increased salinity; crop mortality	Poor farmers	Rainwater harvesting in existing ponds during rainy season; produce crops in dry season (but insufficient quantity); make embankment next to crops to store rainwater for dry season crop growth; cultivate crops only 7 months a year
Soil salinity	5	3	Low rate of crop productivity; threat of insects increased	All farmers	Use fertilizer to remove saline; use insecticide; immediate irrigation to stop saline reaching top soil from groundwater sources; ask advice from UZ Agriculture Office
Drought	5	3	No paddy crops produced (August/ September); very limited supply of vegetables cultivated in dry season for some farmers	All farmers	HH pond irrigation for paddy

Flood	4	3	Crop damage; increased salinity; severe reduction in crop varieties available; cattle mortality due to cattle food scarcity; cattle take longer to reach safe embankment area increasing risk of death	Farmers in south part of the village who live in low-lying areas	Transport cattle/goats by boat to higher land areas; open sluice gate during floods to allow water flow into river; find alternative LHs as agriculture strategies do not work; get resources from Sundarbans

AQUACULTURE:					
Lack of income/capital	4	3	Unable to excavate ponds to facilitate reduced salinity and water supply all year round as increase in labour prices post-Aila; unable to buy PL seeds; unable to buy fish feed; stock less fish seed	Pond owners	Use HH food produce as fish feed (rice)
Flooding:	3	1	Fish escape from ponds; saline fish mortality during heavy rain periods and fresh fish survive; pond embankment damaged/broken; siltation in ponds (as water depth decreases)	Pond owners	Use nets around ponds as protection; harvest fish and sell at the market when saline water enters ponds before mortality occurs; repair pond dikes

Appendix 3- Fieldwork findings: Community stakeholder Theories of Change




Overall TOC Dumuria village, Satkhira District, Shyamnagar Upazila, Gabura Union, Bangladesh (June 2013)
Color Legend
Ultimate outcome
Men outcomes
Joint: men and women
Women outcomes
Increased livelihood resilience of climate vulnerable poor farmers in light of climate and non-climate risks
Increased aquaculture production
Increased agricultural production
Increased community prawn/fish production
Increased disease-free aquaculture production
Climate resilient agricultural and aquaculture practices being scaled out
Knowledgeable farmers acting as UZ extension officers disseminating climate resilient practices
Community accessing fresh water irrigation
Community reducing pond salinity
Community undertaking production with saline tolerant fish species
Community no longer engaged in shrimp farming
Community accessing aquaculture value chains (market)
Women undertaking crab fattening
Fish cultivation with good quality seeds and feed in line with latest technology
Seperate shrimp and paddy cultivation areas operational to avoid salinity issues
Integrating farming systems operational (fresh water gheer)
Community implementing diverse climate resilient agricultural and aquaculture practices
Effective community knowledge sharing platforms operational
Community using ponds in paddy for dry season irrigation
Community using deep ponds
Piped water supply linked to community village
Improved fresh water access by deepened canal by local government
Community undertaking rainwater harvesting for HH agriculture
Community implementing effective pond salinity reduction techniques
Community selling produce collectively
Accessing market prices through mobile phones
UP enforcing rich land owners to not covert paddy land in private gheers
Community accessing good quality seed and feed
Community knowledgeable on identifying best quality fingerlings and fry
Community accessing necessary resources
Community knowledgeable on effective agricultural and aquaculture practices
Community accessing necessary knowledge networks
Community integrating climate change knowledge into planning and decision-making
Women producing crops independently of male community members
Community accessing necessary funding streams
Land owners agree to piped water supply
UP/NGO support supplementing community implementation
Effective Union Parishad and NGO advocacy
FFS savings group cooperative operational
Community using high yield and different varieties of good quality seeds
Community using saline and flood tolerant seeds
Community knowledgeable on climate change risk management
Community committee established
Community undertaking new and pre-Aila seed production/ preservation techniques
Women articulating demands to UP/UZ
UP/UZ responsive to women articulated demands made

Appendix 4

Unpacking the ARCAB CBA Resilience Scale

The ARCAB CBA Resilience Scale moves horizontally from development, to adaptation to climate variability including disaster risk reduction (ACV/DRR), to adaptation to climate change (ACC). Vertically, the scale moves from business as usual (BAU) approaches to development, ACV/DRR and ACC, to those that are 'transformative.' To move towards effective adaptation (with transformative development as part of the process) progress towards the bottom right hand box is needed – transformative ACC.

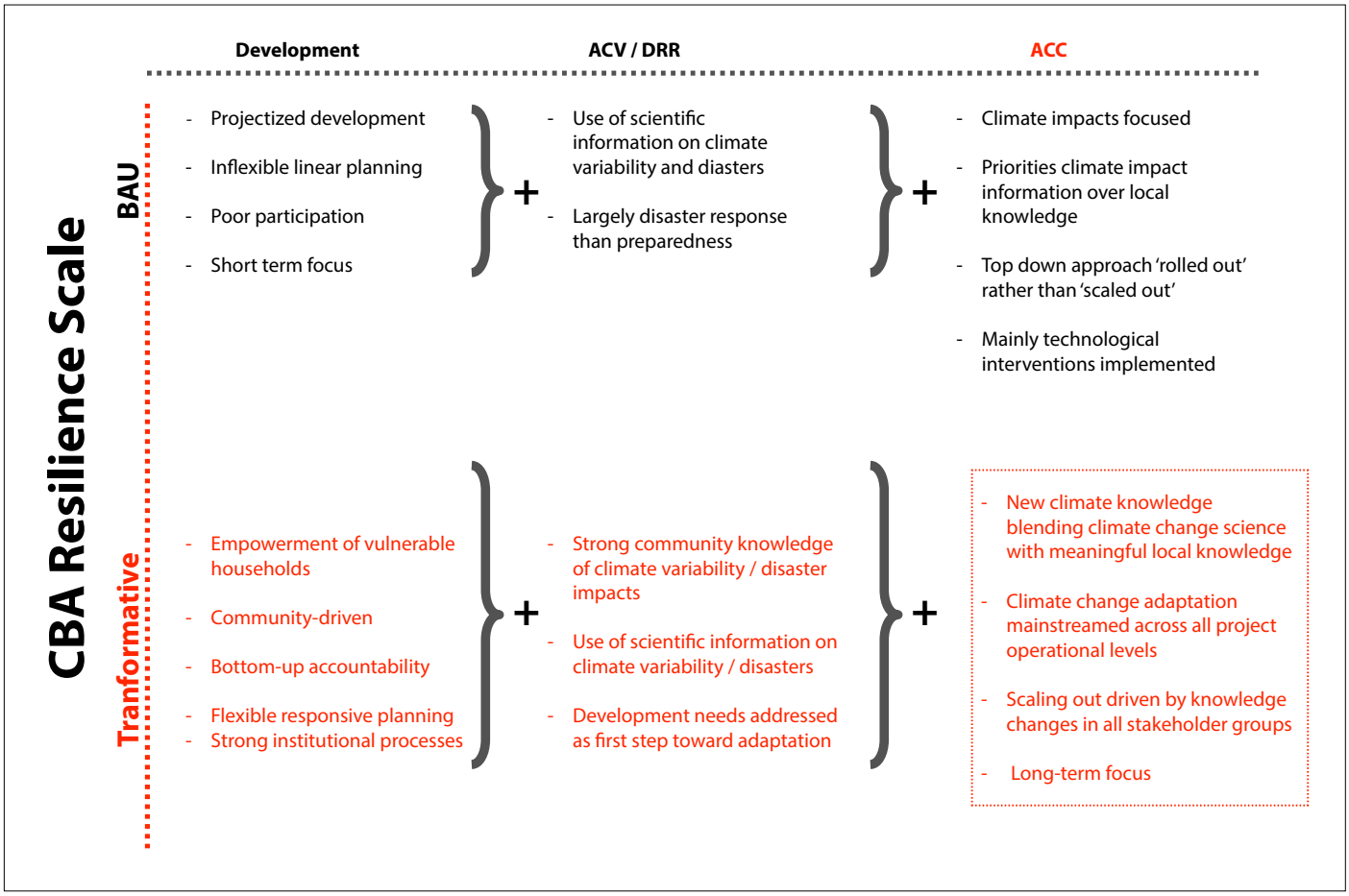


Figure 5: The ARCAB CBA Resilience Scale used to support WorldFish conceptual understanding of moving towards transformative programmatic approaches, starting with development as the first step towards adaptation.

To move towards this goal, changing the methods undertaken and approaches used under what is classed as BAU development and ACV/DRR in figure 5 above is required. As outlined in Section 2 of this document above, this includes:

- Revisiting conventional development and ensuring that the basic needs of the poorest and most marginalized people vulnerable to climate change are being addressed;
- Empowering climate vulnerable poor groups to ensure that their knowledge and demands are reflected in decision-making processes;
- Moving beyond short-term projectized approaches to planning towards integrated approaches that engage with and build the capacity of local to national institutions, with associated sustainable institutional and resource-bases;
- Creating spaces for knowledge sharing and knowledge transfer, to support the scaling up and scaling out of effective processes and practice; and
- Ensuring flexible approaches to planning that can respond to changing needs and incorporate a range of knowledge bases, especially that generated by ultimate project participants.

Similarly, as discussed above, moving towards transformative resilience to "climate change" is largely driven by the integration of new knowledge about adaptation and potential future climate change. This knowledge is co-produced from both improved scientific information about future climate change impacts and adaptation science, and locally-generated knowledge from the climate vulnerable poor about past climate trends and the interaction between climate impacts, vulnerability and adaptation. This blending of scientific and local knowledge is transformational, because it forces development practitioners to rethink the way development planning and implementation are undertaken. Scientific information specifies that climate impacts are becoming more uncertain, hence a lens that provides more dependable information on possible outcomes at the local scale is needed in order to understand what matters to local people. Relying solely on scientific expertise is not enough. Local knowledge is also needed to develop a new kind of knowledge that all stakeholders can use in practice.

It is important to stress that moving towards transformative ACC (effective adaptation) is not just about new climate change information and adaptation science. It also requires transformative development and transformative ACV/DRR approaches to be operationalized (along with associated transformations in attitudes, skills and actions) to support moving towards this goal. This is shown on the CBA Resilience Scale by the addition signs (+). Transformative ACC requires transformative development, plus transformative ACV/DRR approaches, plus other components that may be required.

Appendix 5 - The ARCAB Theory of Change