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A Framework for Monitoring and Evaluation of Good Practice Climate Change Adaptation Options in Agriculture

M&E Design, Methods and Analysis

Technically Cleared
For Final Reading/Editing and Presswork

MDG-F 1656 OUTCOME 3.1
Enhanced CCA Capacity of Communities in Contiguous Fragile Ecosystems in the Cordilleras (The Philippines)

CONTENTS

I. Context and Objectives of Monitoring and Evaluation of Climate Change Adaptation Options

Climate change increases uncertainties in the agriculture sector and directly impacts agricultural production because of the climate-dependent nature of agricultural production systems. Ecosystems and natural resources that support agriculture are affected in different ways and in varying degrees. For instance, shifting precipitation patterns can affect water availability during important plant growth stages while temperature swings can make it more difficult to meet crop thermal requirements. Climate change also affects market elements and infrastructure that support agricultural production. Extreme weather events that cause flooding and landslides can isolate farming communities and trigger higher prices of basic commodities. These are examples of the impacts of climate change that translate to increased production uncertainties and risks, which adversely affect the income and food security of vulnerable farming households.

Although climate change is a global phenomenon, adapting to its impacts is a local process. People and communities adapt to the changes they experience in their day-to-day lives, which are not just caused by climate change, but are also linked to other factors such as environmental degradation, overpopulation and poor management of resources. Adaptation to climate change is a natural response by those whose livelihoods are climate dependent. Aside from drawing local or indigenous agricultural knowledge, farmers instinctively adjust by strategically weighing their available alternative livelihood options with the amount of assets they own. They re-allocate limited resources, such as labor and land, to respond to the impacts of climate change. For instance, women's increased participation in small farming activities that augment household income is a common coping mechanism employed by farming households, while men engage in off-farm and non-farm employment. In some cases, local and indigenous knowledge on land use and management, which farmers have employed for many years and even centuries (ADB, 2009), also help mitigate risk and increase coping ability.

However, instinctive coping or adaptation practices by farmers may not always be sound and sufficient, given the number of factors that interact in a particular agricultural ecosystem. This establishes the need to enable farmers adapt to climate change through a process of planned adjustment so that adaptation practices, for instance, do not compound existing environmental problems or create new ones. Institutional blue prints to achieve climate resilient development can be achieved through a portfolio of activities that complement conventional farmers practice (CFP) with scientifically released technologies (SRT). The aim was is design options that sustain and enhance good practices (GPs) in agriculture by introducing scientific technologies that maintain livelihoods while enhancing the immediate and surrounding natural environment.

The relevance of Monitoring and Evaluation (M&E) has increased as climate change gained recognition in development policies and programmes (Frankel-Reed, 2008). M&E is now seen as an important policy and decision-support tool providing accountability and tracking delivery of results, but also provides a range of data sets that offers a venue to accelerate knowledge in defining and designing "climate-resilient" development efforts.

The MDG-F 1656 Outcome 3.1 project was implemented in 2009 to 2011 and designed as an intervention to enhance and innovate existing conventional farmers practices (CFP) by introducing scientifically released technologies (SRT) through pilot-tested field demonstrations. The field demonstrations combined CCA options that cover a range of good practices (GP) and technologies in the crop, livestock, agro-forestry, and soil and water management sectors. The project supported farmers in Benguet and Ifugao of the Cordillera Administrative Region (CAR) of the Northern Philippines. In each province, four (4) municipalities were identified to pilot test good practice CCA options and technologies. These municipalities represent the high, medium and low elevation agro-ecological zones in the region.

Table 1 summarizes the categories of good practice CCA options and technologies covered by the project, their main benefits as well as the natural support systems that are protected and preserved. These major categories were used as the basis for the design of the M&E, which aimed to identify and assess GP CCA options and technologies of farmers in terms of technological suitability, environmental soundness, and socio-cultural and economic acceptability of locally up-graded conventional farmers practices (LUCFP) and scientifically released technologies (SRT).

Table 1: The Categories of the CCA Options

Category of CCA Options	Benefits of Good Practices (GPs)	Natural support system protected
Agro-forestry/Forest Enrichment	Increase vegetative cover by planting trees with commercial value in semi-depleted forest covers and highly erodible open spaces.	Biodiversity and ecosystem services
Soil and Water Management	Sustain water and moisture requirement of crops	Soil, land, and water
Crop production, Livestock & Fishery	Reduce household economic vulnerability; Increase informal safety nets to minimize risk due to climate-related uncertainties	Livelihood security

The monitoring and evaluation was designed and carried out to determine how farmers' practices result in good practices as well as new or existing scientific practices that can help them to adapt to with climate variability and change.

In a nutshell, the M & E aimed to:

Evaluate the ability of good practice CCA options to promote or increase resilience with reference to the following criteria: Technological Suitability, Environmental Efficiency and Effectiveness and Socio-Cultural and Economic Acceptability, i.e.:

Evaluate a) the environmental benefits of adaptation practices related to optimizing land use and b) the effects of water and soil management on agricultural production based on economic valuation.

Estimate the present and potential economic returns on production and household income as a result of Good Practices and Technologies.

Document the socio-cultural acceptability of locally upgraded conventional farmer's practices (LUCFP) and proven scientifically released technologies (SRT) adaptation practices.

II. Conceptual Design and Methodological Frameworks

Climate change adaptation projects may differ in their focus of thematic areas and modalities of processes but often they move towards tracking and evaluating system-wide indicators of resilience along the thematic area from which the M&E is developed. In this project, the UNDP framework provided the spectrum for structuring the monitoring and evaluation of GP CCA options and technologies in contiguous fragile ecosystems in the Cordilleras.

The M&E was structured from an inquiry of how farmers adjust and eventually become accustomed to scientifically released technologies (SRT) integrated into their conventional farming practices. The challenge was how to place technological evaluation into the context of M&E of CCA options and technologies. The technological focus of CCA interventions was contextualized into the expectations of the farming households. For the project team, this technological focus provided the key from which to view the interrelatedness of economic expectations with environmental efficiency and social and cultural acceptability. Another challenge in the design of the M&E was to identify indicators to evaluate technological intervention along coverage, impact, sustainability and replicability.

Figure 1 shows the parallelisms of the UNDP M&E framework with the MDG-F 1656 Ouctome 3.1 M&E framework and how specific M&E approaches were contextualized. The specified thematic area in the project is agriculture and food security in contiguous fragile ecosystems and the specific components of the adaptation process include the introduction of technological interventions into farmers' practices on crop and livestock production, agro-forestry and soil and water management. Through the project, farmer-cooperators were encouraged to carry out sustainable and environmentally-sound practices such as improving water and nutrient retention through forest enrichment and agro-forestry, and optimizing idle lands and open spaces by propagating low tillage buffer crops. These practices and technologies generate a portfolio of environmental benefits and services such as biodiversity and ecosystem enhancement, improved water and soil quality, and optimal land management.

Thus, the components of the adaptation process were viewed in terms of their impacts on the farmers' immediate environment characterized by positive environmental impacts, positive economic effects and socio-cultural acceptance. Coverage, impact, sustainability and replicability were evaluated by creating indicators and integrating these into a multi-criteria evaluation framework.

The M&E was designed in a way that it will be able to assess the multiplier effect and sustainability of the GP CCA options and technologies after the project. This can be done by examining whether skills have been developed to help ensure that the piloting of scientifically released technologies (SRT) will go beyond mere awareness of what should be done and that these technologies are replicated and/or up-scaled.

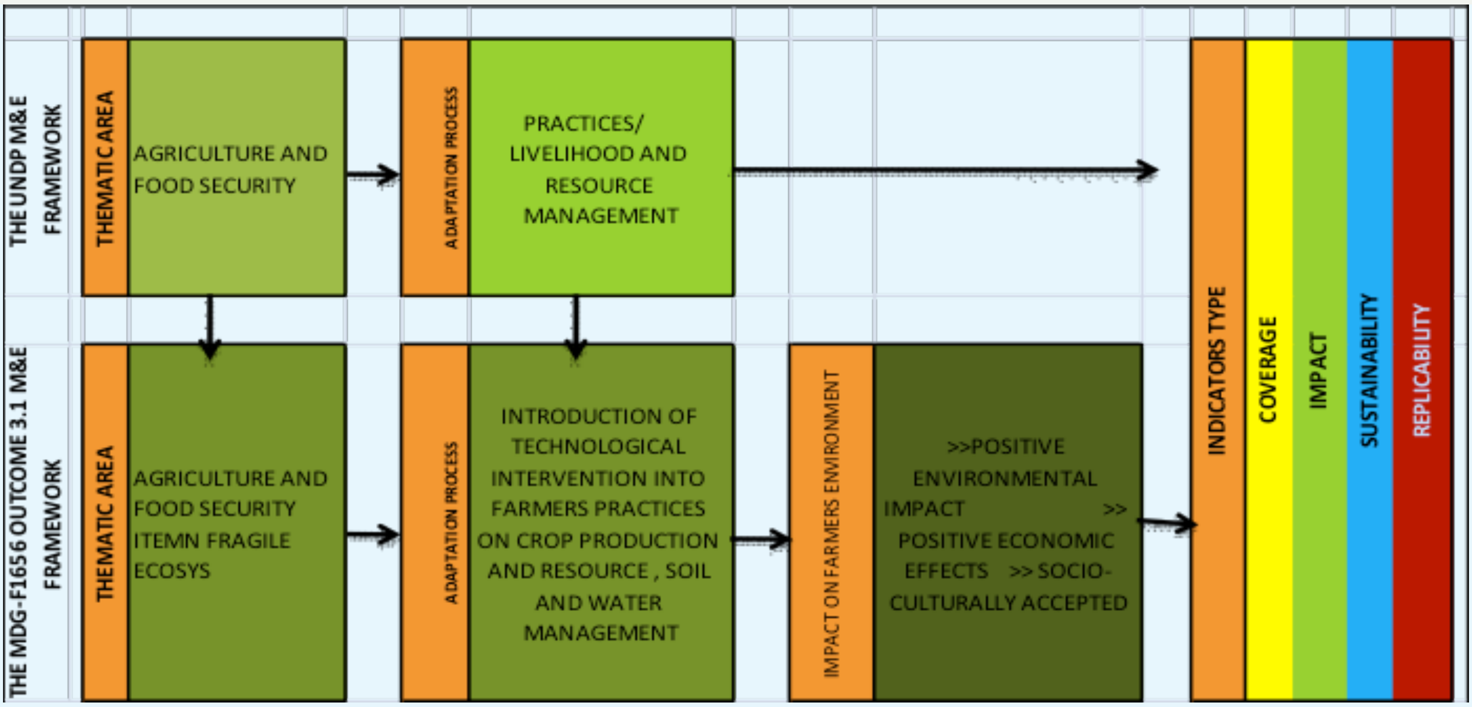

Figure 1: The M&E of the Project MDG-F1656 Outcome 3.1 in the Context of the UNDP M&E Framework

The adaptation response strategies were based on criteria for the selection of the Climate Change Adaptation (CCA) options implemented in selected fragile eco-systems in the Cordillera region of the Northern Philippines. In the following, the criteria for selection are attributed to the indicator types

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Impact

Potential to increase climate resilience
Immediate impact/response to urgent needs

Sustainability

Socio-economic efficiency (socio-economic costs and benefits) and over-all socio-economic impacts for the whole community

Potential positive environmental impacts

Social and cultural acceptance

Promote participation and equal access to opportunities

Sustainability i.e. long term effectiveness of interventions and capacity to continue after the project

Replicability

Potential for up-scaling

The potential to increase resilience to climate change was assessed in terms of the ability to address slow onsetting climate change impacts; the ability to reduce risk of impact from climate variability and extreme events; and enhance livelihood security); and/or to mitigate climate change by reducing or removing GHG emissions or at least not to significantly increase GHG emissions.

The M&E design was based on a contextual vulnerability framing of farm households in contiguous fragile ecosystems in Benguet and Ifugao. Contextual vulnerability is linked to the human-security framing of climate change along factors that expose the individual, the community and the society as a whole to changes in environment, economics and socio-cultural conditions. Climate-society interaction is seen as a two-way process and is inseparable from each other. The project's M&E views human-security framings as a transformative process that affects humans in different ways, and focuses on how they are responding to climate change as they make adjustments to activities that affect their socio-economic and environmental conditions.

The process to assess technological interventions that integrate locally upgraded conventional farmers' practices (LUCFP) and scientifically released technologies (SRT) was framed using an Ex-ante and Ex-post approach. The ex-ante and ex-post approach is designed to evaluate program interventions and is employed to monitor and evaluate how an intervention faired during the project or program cycle with reference to a set of parameters identified by the project implementers.

II. 1 The Ex-ante and Ex-Post Design and the conceptual process

The ex-ante assumption provides the predictive direction of the project or "what could or should happen." It proposes that if the criteria were true, then the project intervention should result to what the ex-ante assumption had predicted. The ex-ante assumption is integrated in the process through a set of criteria that indicate good practice for Climate Change Adaptation (CCA) options and technologies (also called interventions). The two-pronged benefits from the good practice CCA options and technologies assumed and reflected by the ex-ante component are:

Socio-economically make the recipients better-off than they were when there was no intervention;

Improve the state of their environment (i.e. forest, land, and water): from status quo to enhanced quality of ecosystems, which directly and indirectly affect agricultural activities.

The M&E used a common set of criteria, which are theoretically (a priori assumption) believed to define the ideal benefits or results from good practice CCA options and technologies. For instance, an a priori assumption for forest enrichment (given that appropriate species are planted and proper planting procedures are observed) is that it will improve soil quality and water infiltration and retention characteristics as well as aid in enhancing micro-habitats for both flora and fauna.

The ex-post evaluation, on the other hand, provided the "what happened" scenario after the recipients were exposed to the intervention. The focus of the ex-post evaluation was therefore to analyze "what happened" from a collection of information about the experiences of project stakeholders. The perspective of an ex-post evaluation is that "an event had happened" and answers the question:

Given the intervention by the MDG-F 1656 Outcome 3.1 project, did the results and documentation address the specific outcome of interest from the ex-ante assumptions?

If it did, then, what inferences can be drawn from the experiences of the individuals and the project implementers for policy options?

If not, then what are the key lessons learned from the experiences?

Figure 2 shows the concept of a processsual and procedural mechanism to monitor and evaluate project interventions.

The development of the ex-ante assumption based on choice and preferences

In the theoretical context of choice and preference, human behavior evaluates baskets of choices from which they form their rationale judgment to choose what is best given a set of parameters. In the context of the project, the identified and field-tested GPs and technologies came from various stakeholders, including farmers, extension workers, and scientists, through a participatory.

The identification of potential CCA options was initiated through a series of workshops conducted in all eight municipalities in March 2010. The objectives of the workshop included (1) familiarization of the participants with the project; (2) familiarization of the participants with climate change concepts; and (3) identification of local good farmers' practices in agriculture and natural resources management relevant to climate change adaptation.

During the workshops, the participants from the pilot communities discussed at length locally observed impacts of climate variability and change on their farming as well as the perceived causes and possible solutions or measures to cope with the observed impacts. Community-observed manifestations included drought, longer rainfall periods, stronger typhoons, and increases in temperature. Identified local causes for the degradation of natural resources included deforestation, forest burning, improper waste disposal, and excessive agro-chemical use. As for possible solutions or measures to cope with the observed impacts, each municipality came up with its list of alternatives, most of which considered by the participants as 'good farmers' practices'.

A subsequent workshop was conducted at the regional level in April 2010 to validate the identified options and prioritize these for pilot testing. The validation process started with a review of the good farmers' practices identified at the barangay level. These were then modified/upgraded by DA experts and scientists from SUCs to qualify as a CCA option in the sense that they are expected to contribute to enhanced climate resilience and that they are not yet practiced by the majority of farmers in the pilot community. Then, the identified options for each municipality were scored based on the eight criteria listed below:

A. Increase Climate Resilience
B. Socio-Economic Efficiency
C. Positive Environment Impact
D. Sustainability
E. Social and Cultural Acceptance
F. Potential for Upscaling
G. Immediate impact/response to urgent needs
H. Promote Participation and Equal Access to men/women

The scoring helped trigger discussions about the expected benefits of each option and was complemented with qualitative discussions. As a result, about five CCA options were prioritized for each demo site, three of them to be implemented during the wet season and two for the dry season. It should be noted that while CCA options were identified based on wet and dry cropping seasons, some of the CCA options included in the list were also classified as wet and dry being long-term options, such as agro-forestry, forest enrichment, nurseries and livestock. The validated, prioritized list was presented during local level meetings with the barangay councils and farmers for their concurrence held in July 2010.

This cycle of meetings for the identification and validation of the potential CCA options was repeated every season, every time adjusting and expanding the potential list of options for field-testing.

The table below shows how existing practices and technologies can be enhanced by upgrading local farmers' practices and introducing scientifically released technologies (SRT) such as those related to Agro-forestry and Forest Enrichment.

Table 2: Agro-forestry and Forest Enrichment

CCA Options	**Agro-forestry & Forest Enrichment**	
Demo Site	Benguet and Ifugao	
Elevation	High, Medium, Low	
Source of GP and Technology	Local working group, DA, FAO Consultants, Farmer cooperators	
Conventional Farmers Practice (CFP)	**Innovative Practices (MDG-F1656 Technological Intervention)**	
	Locally upgraded Conventional Farmers Practice (LUCFP)	**Scientifically Released Technology (SRT)**
(1)Seedlings were propagated on a small scale in the cooperator's backyard. **(2)Traditional farming techniques were limited to food production for household consumption.** **(3)Traditional farming was upgraded to include fruit trees propagation for additional income.**	(1)Up-grading local varieties of fruits for possible commercial production (2)Traditional farming was upgraded to include fruit trees propagation for additional income (3)Propagating new varieties that are not endemic to the area but have commercial potential	Introduction of: (1) Seedling propagation technique through controlled environment (2) A seed bank to increase number of available fruit and indigenous trees for reforestation and reduce slope erodibility (3) Alternative source of income or major source of income (4) Optimized land use through fruit tree reforestation to protect erodible slopes and enhance soil stability along erosion prone areas.

II. 2 The Multi-criteria Analysis Framework

A. The Context

The concept of resiliency is an agglomeration of economic, environment and socio-cultural resiliency(ADB, 2009, p. 24). Resilience is contextualized in the project M&E through three levels:

First Level: The Farmer System. This pertains to a farmer's ability to withstand and recover from stress caused by socio-economic and environmental change. Quantitative measures were developed in the M&E to evaluate the resilience of the farmer to climate change shocks.

Second Level: Farming and Natural Systems. This refers to the dynamics between farming and natural systems such as land, forest and water. Farming is as part of the displacement, deterioration and disturbance of a natural system. Resilience is contextualized here as the ability of BOTH farming and natural systems to recover from stress or impacts of climate variability and change and extreme events.

Third Level: Social Systems. Defined as the ability of social systems to anticipate and plan according to perceived and real changes, stress or shocks or "the ability of institutions to avoid potential damage and to take advantage of opportunities (ADB, 2009)".

Figure 3 summarizes the context and different levels of resilience in the agricultural sector.

CONTEXT		CLUSTER	PROCESS EMPLOYED IN THE M&E	OUTCOME
SYSTEMIC RESILIENCE	FARMER SYSTEM	Economic Indicators	1. Recording of farm activities 2. Valuation of economic returns 3. Documentation of farmers experiences	UP-SCALING POTENTIAL AND SUSTAINABILITY OF CCA OPTIONS
	FARMING AND ENVIRONMENTAL SYSTEM	Environmental Indicators	1. Household survey 2. Valuation of the cost of GPs and technologies 3. Identification of positive features or benefits ofgood practices: 1. maintains and/or enhances quality of natural resources 2. enhances aesthetic value of natural resources 3. reduces or removes GHG emissions	
	SOCIAL SYSTEM	Social and Cultural indicators	1. Evaluate choice and preferences of households through focus group discussions and interview 2. Availability of institution and skills for increase of coverage of GPs and technologies	

Figure 3: The Context of Resilience of the Agriculture Sector (Adopted from ADB, Human Security Framing, 2009, modified) and methods applied in the project

B. The Multi-criteria Analysis (MCA) Framework

This section discusses how the different evaluation criteria identified early on by the different project stakeholders were structured to provide a framework and platform for analyzing the different dimensions of the GP CCA options and technologies.

The idea of the MCA was to come up with a common measurement or common scoring system, as basis for selecting the GP CCA options and technologies for further evaluation, and for up-scaling and replication to areas with similar biophysical and socio-economic characteristics.

A multiple criteria analysis matrix summarized all sub-indicators into the three clusters. Most sub-indicators were qualitative with no quantitative proxy variable that can provide a straight forward evaluation of the options. Since qualitative data is highly perceptual and given the nature of what is to be evaluated, experts were tapped to carry out the qualitative assessments. The MCA summarized the over-all result of an intervention by providing a metrics or number that expressed the extent of the acceptability of the intervention. The metrics were interpreted based on the set of objectives that were laid out at the onset of the intervention by the project.

The number represents a composite of index of acceptability of the intervention along technological suitability, environment effectiveness and efficiency, and socio-cultural acceptability. This was expressed as the acceptability index being the average of the sum of the Scores (S) of the three (N) clusters (c).

$$A = \frac{\sum S_c}{N_c}$$

Where:

A = is the index of acceptability

S_c= is the score per cluster

N_c= is the number of cluster

The index of acceptability provided a composite of the criteria to contextualize the meaning of sustainability. Specifically, an intervention is accepted to be sustainable and up-scalable if it is technologically suitable to local conditions, environmentally effective and efficient, and socio-culturally acceptable.

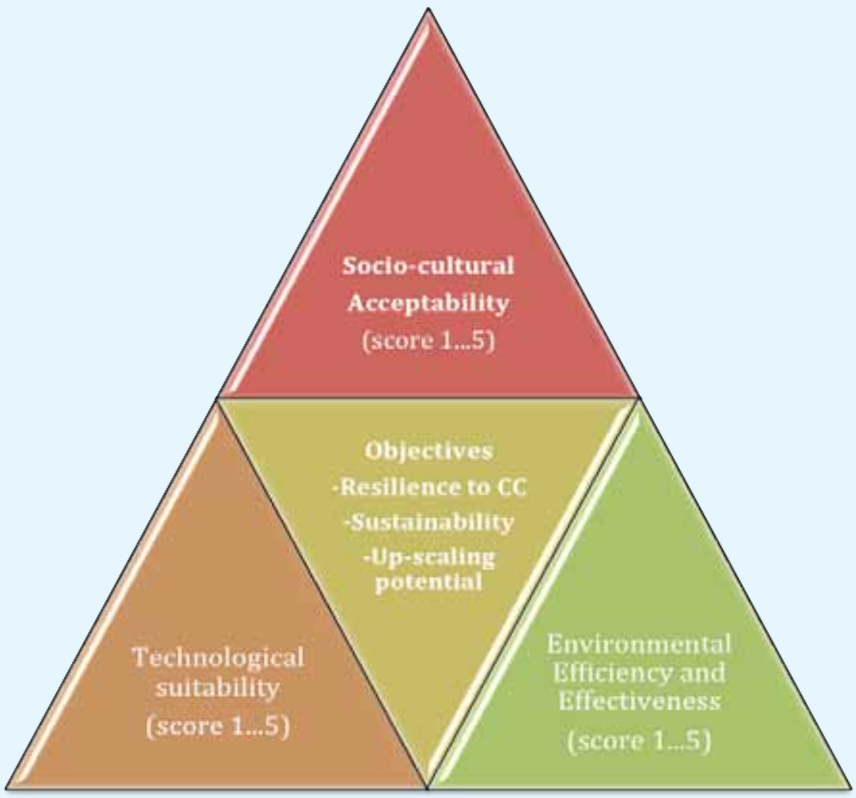


Figure 4: The Clusters of the Multi-Criteria Analysis (MCA) Framework

The resulting index was compared to a perfect score of 5 as the ideal benchmark of acceptability. It has to be recalled that when the options were chosen, they were initially judged (ex-ante assumption) to perfectly comply with the set of criteria laid by the project before the intervention. This implies that the farmers desire that the introduction of scientifically released technologies (SRT) must be at least as good as when there was no intervention, for them to accept the package of GP options and technologies.

If the result falls short of the expected outcome, the ex-post evaluation allows us to identify objectively which cluster manifested low acceptability of GP options and technologies. This becomes the basis for the "lessons learned."

C. Operational Mechanics of the MCA Framework Data Collection

The monitoring was done through a household survey. There were two sets of questionnaires used: one set for crop production and another set for agroforestry, livestock and soil and water management.

During the initial stages of the M&E, a Farm Operations Manual was prepared to monitor and evaluate crop and livestock production. An Agricultural Household Model (AHM) was used as the basis for determining the type of data to be collected and the analysis of farm household response to interventions. Record Forms (questionnaire type) were produced to facilitate recording, collection and encoding of data.

The second set of questionnaires elicited narrative data. The questionnaire was open-ended, allowing the respondent to say as much as she/he can about his experiences on the intervention. The questionnaire was designed to capture the farmer's impression of the technological suitability of the CCA option; it's contribution to environmental enhancement; and economic relevance. The questionnaire elicited quantitative and qualitative responses as a basis for identifying environmental services created by the option and the cost of "having" the environmental services versus "not having" it.

The challenge that the project M&E had to grapple with was the lack of baseline data to compare the data collected from the survey. The workaround was to gather responses from the same respondents whether they were better off with the intervention than when there was no intervention. The responses set the tenor of follow-up questions along environmental and socio-economic indicators of the options. Even with this limitation, the questionnaire-based survey systematically generated data on technological suitability, environmental efficiency and effectiveness, and socio-cultural acceptability of the chosen options. To further compensate for the limitation, the data generated from the questionnaire based-survey was used to evaluate the adaptation options using an ordinal scale for differential metrics. The basis for evaluation of the adaptation options was then to compare benefits of the CCA options to common farmers' practice.

The Operational Framework of the Ex-ante and Ex-post Scoring

When the GP options were chosen, it is with the assumption that they fall within the definition of GP CCA options and technologies. Some of the options were common farmers' practices, while most introduced innovations and techniques to farmers that can help them cope with climate variability and change without trading off economic benefits with environmental concerns.

<table>
<tr><th>CLUSTER</th><th>INDICATORS</th><th>EX-ANTE SCORE</th><th>EX-POST SCORE</th><th rowspan="2">RECOMMENDED FOR UP-SCALING</th></tr>
<tr><td>TECHNOLOGICAL SUITABILITY</td><td>Bio-physical Characteristics of the demonstration site
1. Vegetation
2. Soil characterization
3. Micro-topography
4. Elevation
5.</td><td rowspan="3">5
(HIGHLY ACCEPTABLE)</td><td>IF THE EX-POST SCORE IS 4 &5, THE SCALES ARE INTERPRETED AS HIGH ACCEPTABILITY AND VERY HIGH ACCEPTABILITY</td></tr>
<tr><td>ENVIRONMEN-TAL EFFICIENCY AND EFFECTIVENESS</td><td>Benefits from Environmental Services
1. Value of preventing soil erosion
2. Value of enhanced soil fertility
3. Value of savings from labor
4. Value of water
5. Potential to reduce greenhouse emissions (+, -)</td><td rowspan="2">IF THE EX-POST SCORE IS BETWEEN 3 TO 1, THE SCALES ARE INTERPRETED AS NEUTRAL, LOW ACCEPTABILITY AND VERY LOW ACCEPTABILITY</td><td rowspan="2">NOT RECOMMENDED - LESSONS LEARNED</td></tr>
<tr><td>SOCIO-ECONOMIC ACCEPTABILITY</td><td>Socio-Economic Benefits
(1) Profit
(2) Return on Investment
(3) Social Acceptability</td></tr>
</table>

Figure 5: The Operational Framework of the MCA Scoring

This ex-ante assumption was evaluated through an ex-post evaluation of the options, using a score of 1 to 5 where 1 is the lowest (low acceptability) and 5 is the highest (very high acceptability).

The Multi-Criteria Analysis (MCA) Scoring Technique

The scoring technique involved the following steps:

1. Processing of data from the surveys and interviews

The data generated from the interviews and surveys were processed. For crop production, the indicator for economic efficiency and effectiveness was profit. A simple income statement was generated based on the responses of the cooperators. Profit was also analyzed from an accounting and economic perspective.

The survey generated data on farmers assets to determine how much of their economic resources are employed in farming to determine the Return on Investment (ROI). Fertilizer usage and the size of the demo farm were utilized to compute the rate of fertilizer use as an indicator of the possible environmental impact of a CCA option. The rate of fertilizer use was compared to standard rates of fertilizer use.

2. Content analysis of farmer feedback and comments

Qualitative data such as farmers' feedback and/or comments on the appropriateness and timeliness of the introduction of the GP options and technologies were analyzed and incorporated in the report. Cooperators were given guiding questions on technological suitability, environmental efficiency and effectiveness and socio-cultural acceptability. A sample guiding question is the extent of involvement of women in farm decision-making.

3. Encoding the results in a Scoring Template

The data were then encoded in a template containing information about the project and the results of the monitoring (Please see Sample Template in Appendix B). The quantitative data were straightforward, providing an objective measure of the impact of the GPs and technologies on the farming households. Qualitative data were presented from farmer's observations.

4. Guiding the panel of experts during the evaluation workshop

The Scoring Templates were given to the panel of experts (i.e. Agriculture Technicians) who were directly involved in implementing the field demonstrations.

Before they scored the different GP options and technologies, the experts were provided with overviews about the different field-tested CCA options to facilitate recall and familiarity. Responses of the cooperators during the interviews were also provided. This was followed by the scoring exercise.

5. Validation and feedback

The scores were tallied and provided a qualitative interpretation as follows:

The average scores were presented with emphasis on field-tested CCA options that had low average scores. Focus group discussions were then conducted to draw insights on the weaknesses of the options and possibilities for improvement. Sample tabulation is presented below (Please see Appendix B for full details of the MCA Ex-post Scores).

Range of Average Scores	Qualitative Interpretation
4.00-5.00	Very High Acceptability
3.20-3.99	High Acceptability
2.40-3.19	Neutral
1.60-2.39	Low Acceptability
0.80-1.59	Very Low Acceptability

Summary of results

The results were illustrated using a spider diagram of the three sustainability indicators of GP CCA options and technologies. The spider diagram is more than a visual aid because it provides insight as to which cluster scored very low and allows easier analyses of how the three clusters reinforce or affect one another. For instance, an option that scores very high in terms of environmental efficiency and effectiveness may score low in terms of socio-cultural acceptability. The succeeding section on Data processing, analyzing and interpreting M&E results illustrate how the spider diagram was used to summarize the results and guide discussions.

II. 3 The valuation of the non-market services

A. Economic Valuation of Environmental Services and Benefits

Environmental ethicists assume that individuals themselves cannot ensure the appropriate level of environmental protection because human preferences are based on self-interest and motive. Most environmental services are non-market goods and do not include the intrinsic value of environmental assets. Therefore, market mechanisms through which human preferences are transformed into economic transactions are sometimes not enough to ensure appropriate environmental protection. Since farmers heavily depend on natural resources, they must be made aware of the benefits of enriched natural resources. For instance, planting fruit trees along erodible areas may mean added labor time but provides benefits that go beyond the additional income from the sale of the citrus. In this case, one added benefit is protection from soil erosion, which results in other benefits on and around the farm.

Environmental services, as non-market goods, have no market price, but by identifying surrogate markets, prices were assigned to environmental services in the project M&E. Thus, the surrogate pricing technique was used to value the environmental benefits of the field-tested GP CCA options and technologies. It used market prices as a proxy measure of value of the unpriced good or service being valued (Gregersen, 1996).

The valuation was based on a hypothetical market scenario of having the CCA option versus not having the CCA option. The concept was straightforward: if the co-operators did not adopt the GPs and technologies of the CCA options, then it means they are not willing to allocate time to benefit from its outcome, and on the other hand, if the co-operators did adopt the GPs and technologies, it means they are willing to allocate time to benefit from its outcome. The value of time was then the surrogate price of the environmental benefits, such as preventing soil erosion, minimizing landslides, increasing soil fertility, reducing greenhouse gas (GHG) emissions and contributing to carbon sequestration. The value of time was computed based on the existing agricultural wage and conventional contracting of labor practiced in the community (See Appendix D).

B. Economic Benefits from the Good Practice CCA Options

The farm household is unique in the sense that the economic agent takes the dual personality of resource owner and resource demander. Often, the farmer performs simple calculations of his profit through actual cost paid and incurred during the cropping cycle. However, a simple cash-in and cash-out calculation does not reflect the true value of other economic resources employed by the farmer. Examples include the value of land, physical capital and family owned labor that were inputted in the farm production. The value of water which often is not reflected in the income statement of the farmer must be also factored in the costing of economic resources. Therefore, when all economic resources are paid from the farm revenues, the residual income must be the marginal value of environmental services as a result of choosing the CCA option. Subsidies must be also factored into the calculation of the true profit of the farm enterprise. The Farm Operations Manual, which complements this report, provides details on the model used and procedures carried out to compute the profits and other economic benefits obtained from the good practice option for climate change adaptation. A sample income statement can be found in Appendix D.

III. Setting up the M&E System

In the following the steps followed for setting-up the M&E system are described briefly.

First, a field monitoring and evaluation team was assembled consisting of three enumerators, two field coordinators, RPCMT members (by rotation) and the Monitoring and Evaluation Specialist hired by the project. As mentioned in the preceding sections of this report, the development of the M&E instruments started with the identification of the clusters of indicators of good practices and the identification of the aggregated indicators per cluster. These indicators per cluster were identified during a series of discussions and workshops with the National and Regional Project component management teams from DA as well as the project manager, field coordinators), and FAO consultants.

From the original eight selection criteria, three clusters were identified as criteria for good practice. To be considered as good practice, it must be 1) technologically suitable; 2) environmentally efficient and effective; and 3) socio-culturally and economically acceptable. Sub-indicators for the three clusters were further developed and based on the following operational definitions:

i) Technological suitability - this was simply answered by Yes or No. Given the biophysical characteristics and vulnerabilities of the area, were the chosen options or good practices technologically appropriate for the area? The biophysical characteristics include vegetation, soil characteristics, elevation (in masl), and micro topography.

ii) Environmental efficiency and effectiveness -- in terms of the environmental services obtained due to the implementation of the options; environmental benefits were valued through labor hours saved, potential to decrease green house gas (GHG) emissions, potential for carbon sequestration, etc.

iii) Socio-cultural and Economic Acceptability - in terms of farm profit and marginal contribution to household consumption. Social and cultural acceptability were based on farmers' feedback, insights and opinions on the GP options and technologies.

From the three clusters, a common metrics was put together to measure the acceptability of the option or good practice. The Multi-criteria analysis (MCA) was then developed using a differential metrics with qualitative descriptions for the interpretation of results. Results were summarized using Spider Diagrams.

Subsequently, a Farm Operations Manual and the design of a rapid methodology for gathering demonstration-site specific biophysical data were prepared. The farm operations manual served as the guide in gathering most of the quantitative M&E data. In addition, an interview schedule was defined to extract the qualitative data needed for contextualizing the quantitative data. The M&E instruments were pre-tested and calibrated with a pool of local experts. To satisfy ex-post M&E requirements, the list of data needed for economic valuation was added to the interview schedule.

Data was gathered through farm surveys and scoring workshops with local stakeholders including agricultural and natural resource management experts from SUCs. Additional scoring and more detailed evaluation were carried out through a series of workshops involving national and regional DA staff and FAO experts.

IV. Analyzing and interpreting M&E results

This section demonstrates how the M&E data was analyzed and interpreted by presenting as example one good practice option for climate change adaptation featured in the Compendium of Good Practice Options for CCA in Agriculture: ***Soil property and fertility improvement through composting using trichoderma.***

The characterizationt begins with an overview of the importance and role of healthy soils in agricultural production systems and is followed by a discussion on why soil property and fertility improvement through composting using trichoderma is considered as a good practice for climate change adaptation. These first set of discussions are underpinned by ecological principles to establish the links between healthy ecosystems and agricultural production and how this relates to increasing resilience to climate change impacts.

Overview of Soil property and fertility improvement through composting using trichoderma

Healthy soil plays a major role in resilient agricultural ecosystems. Soils provide a living, dynamic ecosystem and are home to different organisms that carry out many important functions including coverting dead and decaying matter and minerals to plant nutrients. However, farming by default disturbs natural soil processes such as nutrient cycling, which involves the release and uptake of nutrients. Some of these common practices include disc-tillage and vegetation burning which speed up organic matter decomposition and expose the soil to wind and water erosion.

Organic matter provides nutrients and habitat to soil organisms and binds soil particles into aggregates, which improves water holding capacity and aeration. When organic matter, nutrient contents, and soil structure are not restored or maintained during and after planting seasons, nutrient cycles are broken, soil fertility declines and agro-ecological balance is destroyed.

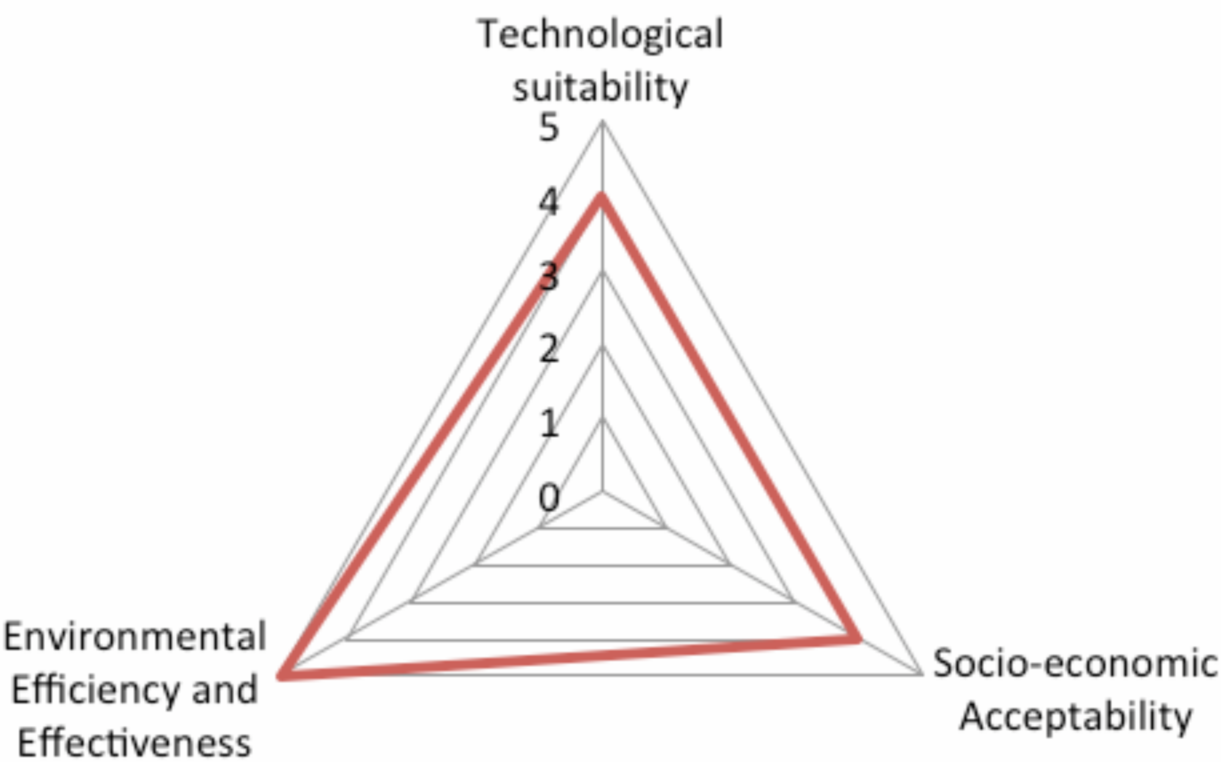
This can make farming systems more susceptible to climate change related events such as heavy or torrential rains, dry spells, droughts, cold spells, frost, and increased or more extreme rainfall and temperature variability.

Soils are also important reservoirs of carbon and play a major role in the global carbon cycle. Living plants gather CO2 from the air and convert it (with sunlight and water) into different plant parts such as seeds, leaves, stems and roots. When plants or some of their parts decompose, some of the CO2 is retained or stored ("sequestered") in the soil.

Soil property and fertility improvement through composting using trichoderma was identified as a good practice climate change adaptation option because it can accelerate compost production, reduce production costs, improve waste management and make farms better withstand climate change related events such as droughts and heavy rains or extreme rainfall events. Trichoderma is a fungi that has the ability to accelerate the composting process. Compost, which breaks down at a slower rate (compared to animal manure for instance), contains humus or humified organic matter. Humus serves as a "bank" or "reserve" for important plant nutrients. As such, soils with high humus content can: a) make nutrients available to crops during times when there are minimal or zero external inputs; b) reduce the need for commercial fertilizers; and c) help ensure plant health which is an important line of defense against pests, diseases, and environmental stress. Humic substances can also dissolve and transport metals and organics in soils and water and affect nutrient availability/distribution and reduce toxicity.

Other benefits from increased soil organic matter and composting include a) better retention of fertilizers and reduced run-off; and b) soil buffering, because the organic matter in compost neutralizes both acidic and alkaline soils and brings pH levels to the optimum range for nutrient availability to plants.

Project Category : SOIL MANAGEMENT		
Option Label: Soil property and fertility improvement through composting using Trichoderma		
Natural Hazard Addressed: Drought, dry spells, flood		
Features and Benefits: Provision of trichoderma for rapid composting. Improved soil fertility; reduced production costs and improved waste management.		
Difference in Local Farmers Practice: farmers use mineral fertilizer		
Suitability(season): wet/dry	**Microtopography Terrain:** Medium elevation	
Water Management System: Rainfed/Irrigation through gravity	**Number and target group:** 1 - Community	
Source(of Information on Technology): farmer, DA	**Project Cost:** 10,600 PHP	**Cost per Cooperator:** 10,600 PHP
Multi-criteria Ex-post Score		



The results of the MCA scoring are presented using spider diagrams and are discussed for each clusters.

For technological suitability, the computed score (rating of 4; high) is interpreted and discussed in terms of the strong and clear scientific links between improved soil property and fertility, increased soil organic matter through composting, and increased resilience to climate change impacts.

Technological Suitability

The above GP CCA option is considered technologically suitable (rating of 4; high) because of the strong and clear scientific links between improved soil property and fertility, increased soil organic matter through composting, and increased resilience to climate change impacts. Composting increases soil organic matter, which results in soils that can help water infiltrate better (also reducing run-off and erosion); store more moisture; contain more readily available nutrients (as well as nutrients in humic substances that can be tapped later); and harbor a diverse mix of soil organisms that will help maintain nutrient availability and control pests and pathogens.

These improvements in the soil ecosystem can then lead to healthier crops and higher yields and a farming system that can utilize water and nutrients more efficiently, reduce commercial fertilizer use, manage wastes more effectively, and be less sensitive to climate change related stress such as droughts, heavy rainfall and temperature swings.

For environmental efficiency and effectiveness, the computed score (rating of 5, very high) is discussed alongside the option's ability to promote reduced fertilizer usage, reduce GHG emissions, and optimize soil acidity levels.

Environmental Efficiency and Effectiveness

Fertilizer Usage (Urea or Amonium Nitrate) per 10 sq. ft.		Potential to reduce GHG	Potential to increase Soil Acidity	Remarks
Standard	Actual	Yes	No	Pure organic farming
4.5 tbs	0 to not more 4.5 tbs			

The above GP CCA Option had a very high rating (score of 5) for Environmental Efficiency and Effectiveness.

In addition to the agro-ecological and climate change adaptation benefits discussed in the proceeding paragraphs, the monitoring and evaluation data revealed that this CCA option has prompted reduced fertilizer usage. Composting, especially when combined with conservation agriculture practices (minimum tillage, crop rotation, cover crops), has a potential to reduce greenhouse gas emissions because when organic matter (in compost) is added to the soil, part of the CO2 will be stored or sequestered in the soil when it decomposes. This Option is also not expected to increase soil acidity because organic matter is mostly "basic" and can bring pH levels down to what is optimum for nutrient availability, water infiltration, and plant growth in general.

For Socio-economic acceptability, the high score of 4 is discussed based on the results of the farm interviews and estimated economic benefits and gains, including the noted higher price of organically grown vegetables.

Socio-economic acceptability

Economic Cost		Output		Market Price	
Organic Fertilizer	Commercial Fertilizer	Organic Fertilizer	Commercial fertilizer	Organic vegetable	Non-organic fertilizer
Lower	Higher	Lower	Higher	Higher	Lower

The GP CCA Option had high (score of 4) Socio-economic Acceptability. Simple analyses based on the farm interview and the 200 square meter demonstration plot in Buguias, Benguet were carried out. The economic cost of organic fertilizer or compost was deemed low. The output or crop yield using the organic fertilizer was also lower compared to commercial fertilizer. However, it was noted that the market price of organically grown vegetables is higher, which could somehow compensate for the lower expected output/yield. It was also found during the interviews that farmer cooperators first found the composting process difficult and frustrating. One cooperator shared that the first trial took 7 months although the process has been shortened to 2 months after the second trial.

The above analyses are then synthesized and used to complement the discussions on the Ability of the Good Practice CCA Option to Increase Resilience to Climate Change. The different factors that operationally define resilience in the context of the project include: a) Capacity to address slow onsetting climate change impacts; b) Capacity to reduce risk and impact of climate variability and extreme weather events (and other hazards); and c) Ability to enhance livelihood security.

Ability of the Good Practice CCA Option to Increase Resilience to Climate Change

Capacity to address slow onsetting climate change impacts

Compared to short-term climate impacts mainly in the form of extreme weather-events, slow-onset climate change takes place gradually and includes for instance, gradual temperature increases that change rainfall patterns, increase evapotranspiration rates, alter pest and disease cycles and reduce soil quality. Healthy soil systems, as a result of increased organic matter via composting and conservation agriculture, can better respond to these impacts by acquiring, favourable physical and chemical characteristics. Some of these include increased water holding capacity and moisture content and presence of organic matter that provides nutrients and buffer against possible soil acidity increases brought about by higher temperatures.

Capacity to reduce risk and impact of climate variability and extreme weather events (and other hazards)

Healthy soils as a result of the said GP CCA option can also reduce the risk and impacts of climate variability and extreme weather events such as droughts, dry spells and heavy rains. Apart from being able to take in more water and hold more moisture that can be used by plants, this type of healthy soils will also prevent surface run-off and erosion. When surface run-off and erosion are prevented, farming inputs such as commercial fertilizers and pesticides will not be carried away by the rainwater from the farming plots thereby saving the inputs and helping prevent pollution of streams, rivers and lakes. Moreover, most of the readily available nutrients are in the top soil and preventing erosion helps retain these nutrients.

Ability to enhance livelihood security

Since this GP CCA Option focuses only on soil property and fertility improvement, nothing explicit can be said about its ability to enhance livelihood security. This is because successful and resilient farming/production would also require improvements in the properties or use of other farming system inputs and components. Soil property and fertility improvement using trichoderma therefore is viewed solely as a strong and important ingredient for increasing the resilience of agricultural ecosystems, in conjunction with other good practice climate change adaptation options that will be discussed in the succeeding sections.

The same approach was applied in the analysis and interpretation of the M&E results for the different good practice options for CCA in Agriculture. Details can be found in the Compendium of Good Practice CCA Options in Agriculture another reports produced through the MDG-F Outcome 3.1 Project.

V. Conclusions

1. Despite conceptual and methodological challenges, monitoring and evaluation of good practice climate change adaptation options in Agriculture is an important tool towards developing proactive, responsive, integrated and scalable climate change adaptation strategies for agricultural landscapes.

2. Participatory Action Research approaches can help to create M&E systems for climate change adaptation that are both simple (i.e. easy enough for community-level implementation) and scalable. Building on previous M&E experiences and carrying out innovative M&E design will help in the identification and structuring of simpler criteria and indicators and user-friendly metrics or scoring systems.

3. To help achieve the twin goal of climate change adaptation and disaster risk reduction, their shared concerns on 'climate-related risks and hazards' should be integral to any M&E system.

4. The inclusion of leading and process indicators in the M&E design is important, especially when monitoring multi-season good practice options for CCA (e.g. agro-forestry), to increase reliability of M&E results and address limitations brought about by short M&E periods (such as two years instead of five years). For instance, projected or estimated annual profit streams can be complemented by leading and process indicators such as seedling/tree survival rates and improvements in soil quality/characteristics.

5. Given limited time and resources, cost-effective data acquisition approaches can help maintain a healthy balance between reliability and cost and serve as an invaluable guide in the design of localized M&E initiatives.

6. Economic valuation of environmental services and benefits (especially market-based methods) in the context of climate change adaptation can be challenging due to data and time limitations. However, with proper and careful use, second-best methods that use cost-estimates, proxy values and surrogate prices can be extremely useful in illustrating and analyzing the environmental services and benefits that can be accrued from good practice options for CCA in Agriculture.

APPENDICES

APPENDIX A: SUMMARY TABLES OF TECHNOLOGICAL INTERVENTION OF THE MDG-F1656 OUTCOME 3.1 PROJECT

Table A.1: Agro-forestry and Forest Enrichment

CCA Options Category	**Agro-forestry & Forest Enrichment**
Demo Site	Benguet and Ifugao
Elevation	High, Medium, Low
Source of GP and Technology	LWG, DA, CONSULTANTS, Cooperators

Conventional Farmers Practice (CFP)	**Innovative Practices**	
	Locally upgraded Conventional Farmers Practice (LUCFP)	**Scientifically Released Technology (SRT)**
(1)Seedlings were propagated on small scale in the cooperators backyard. **(2)Traditional farming techniques are limited to food production for household consumption.** **(3)Traditional farming is upgraded to include fruit trees propagation for additional income.**	(1) Up-grading local varieties of fruits for possible commercial production (2)Traditional farming is upgraded to include fruit trees propagation for additional income. (3)Propagating new varieties that are not endemic to the area but has potential for their commercial values	Introduction of: (1) Seedling propagation technique through controlled environment. (2)A seed bank to increase fruit and indigenous trees for reforestation and reduce slope erodibility. (3)Alternative source of income or major source of income. (4)Optimized land use through fruit tree reforestation to protect erodible slopes and enhance soil stability along erosion prone areas.

Table A.2: Crop Production

CCA Options Category	**Crop Production**	
Demo Site	Benguet and Ifugao	
Elevation	High, Medium, Low	
Source of GP and Technology	LWG, DA, CONSULTANTS, Cooperators	
	Innovative Practices	
Conventional Farmers Practice (CFP)	**Locally up-graded conventional farmers practices (LUCFP)**	**Scientifically Released Technologies (SRT)**
Tolerance to drought; fast maturing crops during dry months; drought tolerant crops breaks also cycle of pests and crop diseases		
Farmers rely on the use of pesticide to control the occurrence of club roots and nematodes. **Crop rotation scheme is a deterrent to climate change-induced diseases; breaks the disease cycle of mono-crops.**		
Farmers allow the rice fields to fallow before the next cropping cycle to retain the moisture of soil and allowing hay to decay for organic or natural fertilizer.		Introduction of: (1) optimal land use during fallow period (2) reduced tillage and less water requiring crops
Propagates crops following their usual planting calendar.	Introduction *of new* variety known for its tolerance to heavy rainfall and prolonged rainfall (i.e. KS Kuroda); Enhancing farmer's awareness of timing of planting to break the disease cycle.	
Farmers reserved seed-potato for the next cropping cycle.	Purchase better seed-potato variety from commercial suppliers.	Production of disease-free seed potato planting materials under a controlled environment.
Planting corn for home consumption	Planting corn on commercial scale using traditional variety.	Introduction of the IPB 13 corn variety an open pollinated type and drought-tolerant variety.
Homestead gardening for home consumption.	**Up-scaled homestead gardening for its commercial value.**	**(1)0ptimal land use by maximizing idle open spaces and sloping spaces in cooperators backyard;** **(2)Homestead farming technique as a preventive measure for grass burning.** **(3) Homestead gardening to enhance biodiversity to control pest.**
Land preparation is done manually.		(1) micro-tiller as complement for labor and labor-saving equipment
Farmers simply leave the abandoned rice fields idle until rain comes to signal the next cropping season.		(1) Optimal land use technique by introducing drought tolerant crops
Seedlings are usually transplanted when they are deemed ready for transplanting.		(1) Early transplanting technique for shorter maturity period
Cooperators usually plant rice only leaving idle open spaces prone to burning during summer.		(1) Optimal land use by maximizing idle open spaces to prevent grass burning

Table A.3. Soil Management

CCA Options Category	**Soil Management**	
Demo Site	Benguet and Ifugao	
Elevation	High, Medium, Low	
Source of GP and Technology	LWG, DA, CONSULTANTS	
	Innovative Practices	
Conventional Farmers Practice (CFP)	**Locally up-graded conventional farmers practices (LUCFP)**	**Scientifically Released Technologies (SRT)**
Weeds, rice stalks and post-harvest vegetables are stacked and left to decay in the farm		Provision of trichoderma for rapid composting
Provision of trichoderma for rapid composting.	Improved soil fertility; reduced production costs and improved waste management.	Introduction of trichoderma for rapid soil composting and improved waste management.

Table A.4: Water Management

CCA Options Category	**Water Management**	
Demo Site	Benguet and Ifugao	
Elevation	High, Medium, Low	
Source of GP and Technology	LWG, DA, CONSULTANTS	
	Innovative Practices	
Conventional Farmers Practice (CFP)	**Locally up-graded conventional farmers practices (LUCFP)**	**Scientifically Released Technologies (SRT)**
Rehabilitation and repairs is done through the bayanihan system.	Members who cannot commit their labor for the rehabilitation and repair of the irrigation should at least pay for man days work.	
Farmers rely on rainy season for water.	Introduction of water management system to enhance and insure growth of trees for climate change mitigation	
Crop production rely on rain fed system	Increase use of fertilizers during dry months.	Provision of plastic storage tanks for use during dry months.
Farmers rely on the onset of rainy season to propagate crops.	Increase use of fertilizer to complement water use to hasten maturity of crops.	Provision of water storage to protect water source from contamination and insure water during dry months.

Table A.5: Livestock and Fishery

CCA Options	Livestock and Fishery	
Demo Site	Benguet and Ifugao	
Elevation	High, Medium, Low	
Source of GP and Technology	LWG, DA, CONSULTANTS, Cooperators	
	Innovative Practices	
Conventional Farmers Practice (CFP)	**Locally up-graded conventional farmers practices (LUCFP)**	**Scientifically Released Technologies (SRT)**
No identified IP or UIP		Maximize use of excess irrigation water
Swine are usually free range; Native swine are usually raised	Hybrid and native swine are kept in sty pens and fed with commercial feeds.	Introduction Duroc as upgraded swine to acclimatize to the region's weather
Chicken are usually free range; Native chicken are usually raised	Chicken are fed with corn and feeds.	Introduction of Sasso/Kabir Chicken raised free range style for acclimatization
Pests were controlled using pesticides. **Ducks were raised for food and not to control pest in rice production.**		Introduction of a non-chemical based of controlling pest in rice production while augmenting farmers income through duck raising.
Raising cattle on free range system; to the locality	**Raising the usual cattle native**	Introduction of new breeds of cattle; Raising cattle as fire deterrent.

APPENDIX B: TABULATION OF RESULT OF MCA EX-POST SCORES

Table B.1: MCA Ex-post Scores for Agro-forestry in Ifugao

CCA Options	Good Practice & Technology	Municipality and Elevation	MCA		Remarks
			Average Score	Interpretation	
IFUGAO					
Agro-forestry & Forest Enrichment	Establishment of fruit tree-based nursery	Alfonso Lista Low	3.6	High	Cooperators are generally neutral on the socio-economic benefits because the expected streams of income are long term.
	Riverbank rehabilitation using Lanao Bamboo		4.3	Very High	
	Rambutan for forest enrichment	Kiangan Medium	4	High	
	Coffee for forest enrichment		4	High	
	Pomelo for forest enrichment		4	High	
	Improvement of Municipal Nursery		4	High	
	Establishment of community-based fruit and indigenous tree nursery	Mayoyao High	3.8	High	Very low on socio-cultural acceptability
	Planting of bananas in sloping backyards		4.5	Very High	Raised primarily for additional income
	Coffee for forest enrichment	Banaue High	4	High	Cooperators are generally neutral on the socio-economic benefits because the expected streams of income are long term.
	Calamansi for forest enrichment		3.8	High	
	Lemon for forest enrichment		3.6	High	
	Mahogany for forest enrichment		3.8	High	
	Establishment of community-based fruit tree nursery		4	High	

Table B.2: MCA Ex-post Scores of Agro-forestry in Benguet

CCA Options	Good Practice & Technology	Municipality and Elevation	MCA		Remarks
			Average Score	Interpretation	
BENGUET					
Agro-forestry and forest enrichment	Planting of lemon and calliandras as wind breaks in vegetable gardens	Tuba Low	3	Moderate	Cooperators are generally neutral on the socio-economic benefits of the CCA options.
	Establishment of community-based fruit tree nursery	Sablan Low	3.8	High	
	Fruit tree orchard establishment		3.8	High	
	Coffee for forest enrichment	Buguias Medium	4.8	Very High	Cooperators foresee coffee and lemon as an alternative major source of income in the long run; lifestyle changes are market signals to reckon on the increasing trend for healthier food and beverages.
	Integrating lemon in vegetable farm as slope protection		4.5	Very high	
	Integrating lemon in vegetable farm as slope protection	Atok High	4.7	Very High	

Table B.3: MCA Ex-post Scores of Crop Production in Ifugao

CCA Options	Good Practice & Technology	Municipality and Elevation	MCA		Remarks
			Average Score	Interpretation	
IFUGAO					
Crop production	Planting of open pollinated corn variety	Alfonso Lista Low	3.6	High	The open pollinated variety yielded less than the usual variety, but seeds can be stock for succeeding planting season.
	Homestead gardening of season responsive crops		4.8	Very High	Homestead gardening can augment income on a weekly basis.
	Integrated fishpond and vegetable gardening		4.8	Very High	Income from the fishpond are perceive as returns for using open space marshlands.
	Rice-vegetable production	Kiangan Medium	4	High	Vegetable production provides additional income and food to the cooperator.
	Homestead vegetable gardening of season responsive crops		4	High	Homestead gardening can augment income on a weekly basis.
	Early transplanting of tinawon rice	Mayoyao High	4.8	Very High	Early transplanting reduce the cropping cycle by at least 30 days.
	Homestead gardening using semi-temperate vegetables		4.8	Very High	Homestead gardening can augment income on a weekly basis.
	Planting garlic in abandoned rice fields	Banaue High	4	High	The garlic color and texture are not at par with the usual garlic quality but cooperators are still willing to try to plant garlic to maximize abandoned rice field.
	Planting gabi in abandoned rice fields		4	High	Production from gabi can augment income and food requirement of households.

Table B.4: MCA Ex-post Scores of Crop Production in Benguet

CCA Options	Good Practice & Technology	Municipality and Elevation	MCA		Remarks
			Average Score	Interpretation	
BENGUET					
Crop Production	Planting of drought tolerant crops	Tuba Low	4.2	Very High	Conventional GP as buffer crops.
	Fallow cropping: Garlic after rice		3.8	High	Socio-cultural acceptability is observed to be neutral. This is the first time for farmers to plant garlic after fallow, it is understandable that they have doubts on the economic feasibility of the GP.
	Crop rotation: Beans, cucumber and tomato	Sablan Low	3.8	High	The introduction of the new variety was not technologically suitable to the elevation of the area.
	Potato seed production in greenhouse	Buguias Medium	4.8	Very high	Saves search and transaction cost due to the proximity of the source of seeds to the community.
	Crop rotation: Potato after garden peas		4	High	An upgraded GP to break the cycle of disease and timed for high prices in the market.
	Planting KS Kuroda variety carrots as tolerant to heavy and prolonged rainfall	Atok High	4.5	Very High	The socio-economic acceptability is very high, but farmers are aware of too much fertilizer use to the environment.
	Planting Lucky ball variety cabbage as tolerant to heavy and prolonged rainfall		4.5	Very High	
	Crop rotation: Potato and Cabbage		4.8	Very High	The introduction of the new variety was not technologically suitable to the elevation of the area.
	Planting of drought tolerant and short maturing variety of cabbage (Scorpio)		4.5	Very High	Conventional GP as buffer crops
	Cabbage crop protection measurement against clubroot using trichoderma		4.5	Very High	Cooperators are still willing to try trichoderma despite its poor performance in the first comporting trial. They foresee the potential of soil composting of controlling for plant pests and diseases.
	Potato crop protection measure against nematodes using trichoderma		4.5	Very High	

Table B.5: MCA Ex-post Scores on Soil Management In Ifugao and Benguet

CCA Options	Good Practice & Technology	Municipality and Elevation	MCA Average Score	MCA Interpretation	Remarks
IFUGAO					
Soil Management	Soil property and fertility improvement through composting using trichoderma	Kiangan Medium	2	Low	Cooperators were not willing to try composting after the failure of the first trial. They also find the trichoderma expensive.
	Soil erosion control in buffer areas	Mayoyao High	1.6	Low	Poor cooperation to implement the GP.
	Improved land preparation through Microtiller	Banaue High	3.8	High	Saves on labor time.
BENGUET					
	Soil moisture conservation during dry months by mulching	Atok High	3	Neut ral	Mulching is not appropriate for vegetable production where precipitation and rainfall is unpredictable.
	Soil property and fertility improvement through composting using trichoderma	Buguias Medium	4.3	High	Cooperators are still hesitant to use trichoderma for soil composting. The process takes about 2-7 months which frustrate some farmers.

Table B.6: MCA Ex-post Scores on Water Management in Ifugao and Benguet

CCA Options	Good Practice & Technology	Municipality and Elevation	MCA		Remarks
			Average Score	Interpretation	
IFUGAO & BENGUET					
Water Management	Rehabilitation of irrigation canal	Banaue High	4.3	High	Cooperation was a problem to finish the repairs.
	Water for agroforestry	Tuba Low	4.2	High	A must-have infrastructure to support vegetable production.
	Water storage for vegetable production	Atok High	4.8	Very high	
	Water storage for vegetable production	Buguias Medium	5	Very high	A must-have infrastructure to support vegetable production
	Small water impoundment for irrigation to augment water for vegetable production		4.7	Very high	
	Water pump as irrigation support for crop production		4.4	Very high	

Table B.7: MCA Ex-post Scores on Livestock Raising In Ifugao and Benguet

CCA Options	Good Practice & Technology	Municipality and Elevation	MCA		Remarks
			Average Score	Interpretation	
IFUGAO					
Livestock Raising	Raising of upgraded swine	Kiangan Medium	3.8	High	Upgraded chicken may not naturally adapt to new environment, but livestock raising is generally seen as an important household asset because it provides the household non-formal security during onslaught of strong rains and typhoons which may damage their crops.
	Raising of upgraded chicken		2.2	Low	
	Raising of upgraded swine	Mayoyao High	4.2	Very High	
	Raising of upgraded chicken		4.1	High	
	Raising of ducks for biological control in rice production		4.4	Very High	
	Raising of upgraded chicken	Banaue High	3.5	High	
BENGUET					
	Raising of upgraded cattle	Tuba Low	3.5	High	Cattle is raised for its economic significance.

APPENDIX C: SAMPLE TEMPLATE USED IN THE EX-POST MCA SCORING

<table>
<tr><td colspan="5">Pilot demo information
CCA Option Category :CROP PRODUCTION</td></tr>
<tr><td colspan="5">Option Label:
Planting KS Kuroda variety carrots as tolerant to heavy and prolonged rainfall</td></tr>
<tr><td colspan="5">Natural Hazard Address: Heavy rainfall</td></tr>
<tr><td colspan="5">Feature:
KS Kuroda variety is known for its tolerance to heavy rainfall and prolonged rainfall.</td></tr>
<tr><td colspan="5">Benefits from the CCA:
Resilient to heavy rains and correct timing of planting can help break the disease cycle.</td></tr>
<tr><td colspan="5">Difference in Local Farmers Practice:</td></tr>
<tr><td colspan="5">Usually plant any variety</td></tr>
<tr><td colspan="3">Suitability(season):
Wet</td><td colspan="2">Microtopography Terrain:
High elevation</td></tr>
<tr><td colspan="3">Water Management System:
Rainfed/Irrigation through gravity</td><td colspan="2">Number and target Group:
6 Farmers</td></tr>
<tr><td colspan="3">Source(of Information on Tecnology):
Farmer, Department of Agriculture</td><td>Project Cost:
48,000 PHP</td><td>Cost per Cooperator:
8,000 PHP</td></tr>
<tr><td colspan="5">DATA RESULTS FOR THE MCA EX-POST SCORING</td></tr>
<tr><td colspan="3" rowspan="2">Indicators of Good Practices</td><td colspan="2">Data Results and Analysis</td></tr>
<tr><td>Monitoring Results</td><td>Evaluation (Score)</td></tr>
<tr><td rowspan="2">Technological suitability</td><td colspan="2">Is the CCA option technologically suitable to the area?</td><td>Yes</td><td>4</td></tr>
<tr><td colspan="2">Remarks</td><td colspan="2"></td></tr>
<tr><td rowspan="4">Economic Effectiveness</td><td rowspan="2">ROI</td><td>Accounting</td><td>54%</td><td rowspan="3">5</td></tr>
<tr><td>Economics</td><td>11%</td></tr>
<tr><td colspan="2">Immediate Response to urgent needs</td><td>Yes</td></tr>
<tr><td colspan="2">Remarks</td><td colspan="2">“Good market price” contributed to high ROI</td></tr>
<tr><td rowspan="4">Environmental indicators (How had farmers practice or innovation helped protect the environment ?)</td><td colspan="2">Practice contribute/minimize GHG emissions</td><td>Contributes to GHG emissions</td><td rowspan="3">4</td></tr>
<tr><td rowspan="2">Rate of fertilizer use (Urea)</td><td>Actual</td><td>4.5</td></tr>
<tr><td>Standard</td><td>8.5</td></tr>
<tr><td colspan="2">Remarks</td><td colspan="2">Most farmers are anxious that using less fertilizer will reduce crop yield</td></tr>
<tr><td rowspan="2">Social-cultural Acceptability</td><td>Gender participation</td><td></td><td>Women are decision makers</td><td rowspan="2">4</td></tr>
<tr><td>Farmers and community</td><td></td><td>Highly accepted</td></tr>
</table>

APPENDIX D: ECONOMIC ANALYSIS OF A FARM INCOME

OPTION TITLE: Planting of Lucky Ball Variety Cabbage as tolerant to heavy and prolonged rainfall
Establishment Cost: Php10,000
Cost Per Cooperator: Php10,000/2 =Php5,000
ACTUAL SUBSIDY RECEIVED BY COOPERATOR: PHP6250
Option Feature: Lucky Ball variety is known for its tolerance to heavy and prolonged rainfall
Season Evaluated: Wet season (covering August to December 2010)
Municipality: Atok, Benguet (High Elevation)

Economic Analysis of the Farm Enterprise

Farm Transactions	*Accounting*	*Economic Accounting*	
		With Implicit co:	*With Subdidies*
Gross Sales (2,000++kilos)	**26,307.00**	**26,307.00**	**26,307.00**
Less: Percent consumed			
Feeds to animals			
Net sales	26,307.00	26,307.00	26,307.00
Less: Explicit Costs			
Hired Labor	8,550.00	8,550.00	8,550.00
Transportation	3,473.00	3,473.00	3,473.00
Farm Inputs	1,500.00	1,500.00	1,500.00
Total Cost	**13,523.00**	**13,523.00**	**13,523.00**
Accounting Profit	**12,784.00**	**12,784.00**	**12,784.00**
Less: Implicit Cost			
Est. Rent Payment for land		3,116.00	3,116.00
Own Labor		2,500.00	2,500.00
Est. Payment for use of equip't		500.00	500.00
Total Economic Cost		**18,900.00**	**18,900.00**
Economic Profit		**7,407.00**	**6,668.00**
Less: Implicit Cost			
Subsidies from SPICACC			6,250.00
Total Economic Cost			**25,150.00**
RESIDUAL VALUE for Payment of Environmental Services			**418.00**

Impact of the MDG-F 1656 Outcome 3.1 to Household Income

Sources of Household Income	*Farm Household Income*	
	without subsidies	*with subsidies*
Rent for own land	*3,116.00*	*3,116.00*
Payment for use of equip	*500.00*	*500.00*
Wages from the farm	*2,500.00*	*2,500.00*
Profit from the farm	*9,668.00*	*9,668.00*
Farm Household Income	*15,784.00*	
Add: Subsidies from SPICACC		***6,250.00***
Total Farm Household Income		***22,034.00***

Analysis: Using the Agricultural Farm Household Model (AHM) we analyze the economic impact of adopting this option in terms of the economic return to the farm enterprise, and it's impact on the household income. Report from the cooperator of his farm transactions show postive results of profits at all levels of analysis. The positive economic profit shows that the farm as an enterprise is capable of paying economic resources supplied by the household. This implies further that household's as investor to the farm enterprise can recover their investment on land and equipment by adapting good practices attuned to climate changes. Even with additional cost of farm inputs (from subsidies) the yield coupled with good market prices implies that Lucky ball as an alternative variety insures farm profitability even when the farm enterprise incurs higher cost to mitigate the impact of heavy rainfall. As a consequence the profitability of the farm enterprise choosing this option insures positive returns to the household as investor, worker and farm manager.

APPENDIX E:
SUMMARY OF GOOD PRACTICE ADAPTATION OPTIONS

Table E.1: Summary of recommended CCA GP Option Chosen identified in the project GP and Technology

	CCA Option	Elevation/Location
1.Riverbank rehabilitation using Lanao Bamboo	Agro-forestry and forest enrichment	Low, Ifugao
2. Homestead gardening of season responsive crops	Crop production	Low, Ifugao
3. Coffee for forest enrichment	Agro-forestry and forest enrichment	Medium, Ifugao
4. Rambutan for forrest enrichment		
5.Pomelo for forest enrichment		
6. Early transplanting of tinawon rice	Crop Production	High, Ifugao
7.Coffee for forest enrichment	Agro-forestry and forest enrichment	High, Ifugao
8.Planting gabi in abandoned rice fields	Crop Production	
9. Fallow cropping: Garlic after rice	Crop Production	Low, Benguet
10.Integrating lemon in vegetable farm as slope protection	Agro-forestry and forest enrichment	High, Benguet
11.Planting KS Kuroda variety carrots as tolerant to heavy and prolonged rainfall	Crop Production	High, Benguet
11.Potato seed production in greenhouse	Crop Production	Medium, Benguet
13. Soil property and fertility improvement through composting using trichoderma	Soil Management	
14. Small water impoundment for irrigation to augment water for vegetable production	Water Management	

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