Workshop Report: AAS-2012-22

Strengthening Impact Evaluation in Natural Resource Management

CGIAR

RESEARCH PROGRAM ON
Aquatic Agricultural Systems

Workshop Report: AAS-2012-22.

Strengthening Impact Evaluation in Natural Resource Management

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Please cite this report as:
CGIAR Research Program on Aquatic Agricultural Systems. (2012) Strengthening Impact Evaluation in Natural Resource Management Workshop Report, 4-5 September 2012, Penang, Malaysia. CGIAR Research Program on Aquatic Agricultural Systems. Penang, Malaysia. Workshop Report: AAS-2012-22.

Acknowledgments:
This report is a documentation of the workshop process and outputs. The facilitators would like to acknowledge the workshop participants for the insights and inputs presented in this report. If you have any questions or need clarification regarding this report, please email Dr. Boru Douthwaite at b.douthwaite@cgiar.org.

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I. Executive Summary

Natural Resource Management Research (NRMR) differs from agricultural commodity research due to its complex, multi-scale, multi-stakeholder and place-based focus. In the new CGIAR, it takes place in CGIAR Research Programs (CRPs) that seek, through a focus on outcomes and impact, to contribute to poverty reduction through building more resilient and sustainable agricultural systems. Evaluating the impact of such complex programs presents methodological challenges to traditional impact evaluation designs and methods. WorldFish and partner institutions are responding to the challenge by exploring new approaches to NRMR impact evaluation to support the development of legitimate, effective and credible methodologies and processes that respond to the characteristics of NRMR programs. Work in this direction was supported by a Small Research and Development Activity (SRA) grant through ACIAR funding, with the goal of identifying the challenges faced and undertaking a literature review to help build appropriate responses. Through building a community of practice of NRMR monitoring, evaluation and impact assessment experts working within and outside the CGIAR, and commissioning two eminent evaluation scholars and practitioners (John Mayne and Elliot Stern) to write a position paper on impact evaluation design and methodologies for NRMR, the activities of the SRA have contributed to the development of a learning-based approach to NRMR impact evaluation.

During the workshop on Strengthening Impact Evaluation in Natural Resource Management held in Penang on September 4–5, 2012, a core group of the NRMR impact assessment community of practice met to discuss design and methodological challenges for NRMR impact evaluation, to agree on the main propositions of a learning-based approach, and to develop a plan for communicating to key stakeholders and deciding on actions to move the agenda forward. The position paper developed a learning and accountability approach to NRMR impact evaluation that argues for mixed methods and a broader set of indicators to respond to the needs of a diversity of stakeholders. The proposed approach is based on using a multiplicity of methods that link to appropriate causal chains along identified impact pathways within a Theories of Change framework. The group further agreed that a major challenge to the acceptance of this approach is the lack of recognition of a range of robust ways to demonstrate causality. In response to this, a prioritized list of opportunities for developing methods (such as standardizing quantification of qualitative data or developing methods that introduce uncertainty in both the specifications of the model and its specific biophysical changes) and capacity-building needs within and across the CRPs provides a springboard for future strategic and practical actions that can strengthen NRMR impact evaluation.

The position paper was strengthened through the workshop and will provide an important vehicle for raising awareness of and legitimizing learning-based NRMR impact evaluation processes aligned to the goals and approaches of the new CGIAR Strategy and Results Framework and our collective goal of poverty reduction.

II. Rationale

Background

The workshop on Strengthening Evaluation in Natural Resource Management Research is part of an ACIAR-funded Small Research and Development Activity (SRA) on Assessing the Impacts of Natural Resource Management and Policy Research in Development Programs, with WorldFish and Commonwealth Scientific and Industrial Research Organization (CSIRO) as partners. The SRA objectives included a review of literature to identify challenges in assessing the impact of NRMR programs and to propose a framework that addresses them. An exploratory workshop was held in February 2012 to initiate collective action within the CGIAR Research Programs (CRPs) to identify and address their impact challenges (report available at http://www.worldfishcenter.org/resource_centre/WF_3038.pdf) and led to the creation of the NRMR impact community of practice (COP). Since February, the COP—engaged as a Google group—has discussed and guided the development of a position paper by two experts in the field of impact evaluation (IE), commissioned by WorldFish under the SRA. The position paper develops a framework for undertaking IE within complex NRMR programs. At the same time, CSIRO carried out a literature review of quantitative IE approaches.

This follow-up workshop brought together members of the COP and partners in the SRA to discuss and reach agreement on how to progress on our collective goals of building new and appropriate approaches for NRMR IE and how to put these approaches into action through our research programs. The position paper was used as a vehicle for structuring discussion around the proposed approach and our collective action to legitimize it and practically implement it through our NRMR programs.

Objectives

The objectives of the workshop as defined in the agenda were the following:

- To agree on a framework for NRMR IE.
- To identify priorities for strengthening NRMR IE in ACIAR, CSIRO and participating CRPs.
- To develop an action plan for strengthening NRMR IE in participating CRPs.

Inputs

Three types of inputs were used to structure the workshop sessions and discussions:

1. A draft position paper written by John Mayne and Elliott Stern that accomplished the following:
   - Defined terms and concepts for NRMR IE.
   - Developed a framework for guiding design of NRMR IE.
   - Provided recommendations for improving NRMR IE.
2. A CSIRO-authored literature review on opportunities for quantitative method development with a focus on statistical proof.
3. Invited presentations on implications of the position paper framework for IE in CRPs and for the CGIAR system and from the Center for International Economics (CIE) on IA challenges in NRMR.

Expected outputs

The expected outputs from the workshop as identified in the planning were as follows:

1. An agreed framework for NRMR IE.
2. Inputs necessary to finalize two papers—the position paper and the CSIRO literature review.
3. Elements for an action plan on strengthening NRMR IE in our respective organizations.
4. Agreement on the main message of a communiqué on strengthening NRMR IE.
5. Inputs to a presentation to the European Initiative on Agricultural Research for Development. (EIARD) on how participating CRPs are approaching IE of NRMR (presentation will take place in October).
6. A workshop report.

III. Agenda & methodology

Day 1	
Time	**Item**
8:30	Welcome
8:40	Introduction to workshop agenda and expectations
9:00	Pre-recorded presentation of position paper
10:30	Coffee
11:00	CSIRO presentation + discussion
12:30	Lunch
13:30	IA issues in NRMR + discussion
15:00	Coffee
15:30	Q and A with Elliot Stern
16:45	Close for the day

Day 2	
Time	**Item**
8:30	Implications of position paper framework on AAS M&E and IE + discussion
9:15	Implications of WP on CCAFS M&E and IE + discussion
9:30	Implications of WP on CRP 6 M&E and IE + discussion
10:00	Implications of WP on CGIAR M&E and IE + discussion
10:30	Coffee
11:00	What needs to happen to strengthen IE of NRMR
12:30	Lunch
13:30	What to say to EIARD
14:40	Our main message (for a communiqué)
15:30	Coffee
16:00	Next steps, workshop evaluation and closure
16:30	Close

Using participatory techniques, Boru Douthwaite facilitated the workshop with support from Marina Apgar. Due to the small size of the group (see participant list in Annex 1), an environment of trust and openness was instilled through using an open-dialogue format with a moderator ensuring everyone's participation and the flow of discussion towards the objectives of each session.

Three international participants joined via teleconferencing; the WebEx program was used to provide live sharing of desktops and presentations. Brian Belcher participated in the entire two days of the workshop through WebEx, while John Mayne and Elliot Stern each participated for one session.

As most members of the COP were not present, effort was made to engage them in the workshop. This was accomplished through the following means:

1. All members were provided with a link to a shared folder on Google Drive containing all preparatory material for the workshop, as well as material produced during the workshop, such as the notes taken daily and the presentations made. Members were encouraged to make specific comments on the documents themselves and to send more general feedback through emails to the group.
2. During the two workshop days, three updates were sent via the Google group on the progress of the agenda items and discussions that emerged. Members were encouraged to send their own feedback, comments and thoughts regarding the discussion to be shared in the workshop.

IV. Discussion and agreements around objectives

This section provides a synthesis of the main themes that emerged throughout the workshop sessions and contributed to reaching the workshop objectives.

Objective: Agreement on a framework for NRMR IE

The position paper proposed a framework and approach to NRMR IE. It was shared in its draft format with the COP prior to the workshop, and all were encouraged to comment either on the document or via the Google group. During the first day of the workshop, participants had the opportunity to ask questions and comment on the proposed framework during two sessions with the co-authors. John Mayne presented the position paper in the morning. A question-and-answer session followed the presentation. The discussion that was initiated in the morning was picked up in an afternoon session of questions and answers with Elliot Stern. The following captures the main themes of the discussion, which helped build agreement around the proposed framework.

1. Bridging accountability and learning in NRMR Impact Evaluation

The learning approach proposed for IE in the position paper highlights a process of learning as central to doing NRMR while also discussing evaluation for accountability—these processes must go hand in hand. The group agreed that our implementation should be guided by how to bring them together, rather than by questions of either/or. Examples from ACIAR work of how accountability and learning can be done together in IA were discussed. That there is a difference between doing evaluation for learning and the learning process itself was highlighted. The position paper argued for using theories of change (TOC) to frame the learning process as part of our monitoring, evaluation and impact evaluation design and practice.

Some participants felt that the approach raises a need to build new narratives and ways of understanding causality. A lengthy discussion on causality emerged, and agreement was reached regarding the goal of the framework to legitimize a diversity of causality claims, which can be used within a TOC approach to IE. This, it is proposed, can be accomplished through first building consensus within the COP and then (recognizing that we engage with different stakeholders) finding common language to communicate our causality claims.

As we move up an institutional scale, (for example, from CGIAR center leadership to donors to their constituencies), the need to aggregate results and simplify the messages becomes greater and greater. Nothing aggregates quite like a number. Elliot Stern stressed that in practice, counterfactual claims of causality backed up by dollar values will remain the gold standard for some stakeholders for some time to come. However, there is growing appreciation that it is often more plausible, as well as better for partnership, to seek to show contribution rather than simply attribute a value to the contribution of individual organizations or projects. Proving contribution requires other causal frameworks.

Box 1. Summary of the causal frameworks presented in the position paper.

- *Regularity frameworks* that depend on the frequency of association between cause and effect—the basis for statistical approaches to making causal claims.
- *Counterfactual frameworks* that depend on the difference between two otherwise identical cases—the basis for experimental and quasi-experimental approaches to making causal claims.
- *Comparative frameworks* that depend on combinations of causes that lead to an effect— the basis for 'configurational' approaches to making causal claims, such as qualitative comparative analysis (QCA).
- *Generative frameworks* that depend on identifying the causal links and mechanisms that explain effects—the basis for theory-based and realist approaches to making causal claims.

2. Appropriate unit of analysis and nested design
The position paper identified the cross-scale nature of NRMR as a key attribute with important implications for IE design. NRMR programs can work from plot to farm to community to national, regional and global scales. Work at one scale influences and is influenced by work at other scales. Hence outcomes and impacts need to be evaluated within and across scales. Elliot Stern highlighted that there are few practical examples of how to aggregate up and across levels within such programs. The proposed nested approach is still in its infancy, and the work across CRPs can help us learn and develop it.

The CGIAR system-level outcomes (SLOs) were discussed as based on assumptions about development and poverty that are likely to need revisiting in some years and be realigned with the globalized world and new assumptions about poverty. The cross-scale nature of NRMR is, therefore, a serious challenge to designing IE in the CRPs to capture outputs, outcomes and impact across scales of action and align them with the CGIAR SLOs. The CGIAR will utilize the concept of intermediate development outcomes (IDOs) as significant indicators on impact pathways connecting the CRP outputs to the SLOs. The CGIAR Research Program on Aquatic Agricultural Systems (AAS) example of using nested TOC from project, hub and program levels with IDOs matching household, community, hub and global levels was discussed as an opportunity to learn more about how to do this in practice.

3. Building common language around impact assessment and evaluation
Through discussions among the participants, a distinction in language used within IA and IE fields became evident. Specifically, the group discussed a need to build common language and common narratives to help bridge the IA and IE worlds in this learning and accountability approach. For example, monitoring is understood by some as the reporting of delivery of milestones and expenditure for compliance purposes, while others understand it to be in support of learning and part of real-time evaluation. The problem is that the same words are used to mean different things depending on one's conceptual framework.

One step towards clarification of language came through discussing IE as a process that occurs throughout a program cycle from ex-ante IE to ex-post IA; IA is a subset within this wider field, which seeks to attribute value and impact to different actors and actions.

4. Use of complexity in the position paper
The position paper developed a list of NRMR program attributes as one of the pillars of the proposed framework for appropriate design. Through discussions during the workshop it became evident that some participants were referring to more generally applicable attributes for complex RinD programs, while others were referring to the more specific attributes of NRMR, such as the interactions between social and environmental systems. Some participants argued for a more explicit use of a complexity lens to help make the position paper more broadly applicable.

Through discussion with the position paper co-authors, the group decided that the words 'complex' and 'complexity' have become overused and that a clearer definition of unique NRMR attributes would be more helpful in grounding the framework.

5. Specific feedback for developing the position paper
The group agreed on the following aspects of the position paper to help its development:

i. The position paper is a source document, and it can be repackaged differently for different audiences.
ii. More examples are needed in the position paper to ground the theoretical propositions.
iii. The position paper cannot produce a single blueprint approach to implementing NRMR IE, but rather can point to some common principles to be applied by practitioners.

6. Definition of NRMR attributes
On the second day, in response to the emergent discussion on the use of complexity in the position paper mentioned in point 4 above, the group discussed how to refine the list of NRMR program attributes to focus more specifically on attributes unique to NRMR, such as interaction with natural systems. These were summarized in Table 4 of the position paper. The resulting edited version can be found in Annex 2. In Table 4, the first attributes discussed were unique to NRMR but became more general attributes of complex initiatives as one moved down the list.

7. Agreed propositions as building blocks of a learning approach to NRMR IE
On the second day, the group was polled on their level of agreement on the main propositions laid out in the position paper. These building blocks are to be used in an invited presentation to the EIARD on the AAS approach to IE. The group collectively edited a straw man list of propositions and reached agreement on the following:

1. *IE of NRMR must respond to the needs of a diversity of stakeholders, and this argues for mixed methods and a broader set of indicators.*
2. *Using a multiplicity of methods within a TOC framework may be a good approach to meeting these multiple needs.*
3. *The IE approach will put more emphasis on real-time evaluation and collective learning in support of adaptive management.*
4. *A major challenge to the acceptance of this IE approach is the lack of recognition of a range of robust ways to demonstrate causality.*
5. *A major challenge for working with TOC in programs is how to nest and link across TOC at different scales and dimensions.*
6. *Counterfactual approaches are more plausible when the causal chains are short and simple.*
7. *A challenge to the IE of NRMR is that causal chains tend to be long, dynamic and uncertain. We propose to test Proposition 2 as a way of dealing with this challenge.*
8. *It is necessary to collectively develop TOC between selected stakeholders to inform implementation and the selection of evaluation methods.*
9. *Using TOC with a multiplicity of methods for IE in NRMR programs requires identification of where along the impact pathways different causality claims and methods can be useful and are credible.*
10. *A challenge for practically implementing and communicating this IE approach is around building clear definitions and common language.*

Objective: Identify priorities for strengthening NRMR IE in ACIAR, CSIRO and participating CRPs

Implication of the Framework for CRPs and Others
With the aim of progressing towards identifying the priorities for strengthening NRMR IE in our work, four presentations were made on the implications of the framework presented in the position paper for CRPs and the CGIAR as a whole. Selected presentations are publicly available at http://www.slideshare.net/worldfishcenter.

i. Implications for the CGIAR Research Program on Aquatic Agricultural Systems
First, Charles Crissman framed the AAS approach to IE within an understanding of IE as a process from project planning to ex-post IA, noting that at different times in the process different types of evaluation are required. His main point regarding legitimization of multiple causal frameworks as necessary to move away from the 'gold standard' IA of the CGIAR provoked a discussion around what is and can be argued to be an acceptable logic for causal claims.

Using the framework developed in the position paper, he then discussed accountability and learning goals and challenges for AAS IE. AAS will use nested TOC and IDOs across time and geographical scales. Describing the attributes of AAS and how these relate to the NRMR attributes outlined in the position paper helped sharpen the NRMR attributes discussed in the previous section.

ii. Implications for the cgiar research program on climate change, agriculture and food security (CCAFS)
Patti Kirstjanson was unable to join virtually, but her presentation on the implications of the position paper for the CCAFS CRP was shared, and participants engaged in discussion around certain points that resonated with their own work. First, participants shared the challenge of working across multiple CGIAR centers and communicating between them. This led to a discussion on how to improve capacity building through learning from how different CRPs do IE; this was considered a priority for strengthening NRMR IE.

Participants also shared their responses to a second point made in the presentation about the role of empowerment as an important impact of CRP work and how to best capture it. This led to a discussion around the need to improve our tools for measuring capacity development and network building. Process outcomes of research are often overlooked, both in planning and evaluation of research programs. The group advanced the hypothesis that process outcomes and impact are more important in NRMR than in commodity research. Research process outcomes include the learning, capacity development and social capital built into doing collaborative research (e.g., participatory action research).

iii. Implications for the CGIAR Research Program on Forests, Trees and Agroforestry
Brian Belcher presented the implications of the position paper framework for ForestsTreesAgroforestry. Brian explained how this CRP is organized around components and how their monitoring, evaluation and impact assessment (MEIA) strategy is closely aligned to the NRMR IE framework discussed in the workshop. ForestTreesAgroforestry also has an explicit focus on research for policy that further strengthens the need for alternative approaches to measuring impact. The framework will therefore support their ongoing work. Brian expressed a need for cross-CRP collaboration and capacity building in putting the approach into practice.

The group agreed that sharing the development of their IDOs among the CRPs would be very useful. In their work, CRP 6 has a team that does MEIA across the centers, which work together on the planning and implementation of their IE approach. The discussion focused mainly on how to share across the CRPs and do cross-CRP trainings. Brian also suggested that the methods section of the position paper could be developed further as another output.

iv. Implications for ILAC and CGIAR SLOs
Javier Ekboir presented on the system-level implications for the CGIAR of the approach put forward in the position paper. He argued that there is a need to put at center stage the question of what is valid evidence, as the CGIAR SLOs themselves are based upon assumptions about development. He further highlighted the need for use of new non-experimental research methods couched in participatory methodologies.

He emphasized the need for building a supporting environment, and the discussion that arose focused around the strategic goals of the coalition and where the position paper sits within those larger goals as a document that lays out an approach but that also needs to be used and tested.

Identifying priorities for methodological development
As one of the objectives of the workshop and the SRA in general was to develop an agenda for furthering methodologies to support a mixed-method approach to IE, two presentations were made to focus discussion on methodologies.

First, Ross Darnell from CSIRO presented his progress on one of the SRA-commissioned papers that aimed to provide a literature review and identify opportunities for methodological development. The presentation discussed a range of methodologies in use for IA, ranging from experimental methods such as randomized control trials (RCTs) to qualitative methods such as case studies. The discussion that followed touched upon the applicability, benefits and costs, and associated sampling challenges of using experimental methods, such as RCTs, in NRMR IE. The applicability of case studies and inductive theory development together with TOC were also discussed.

Ross then proposed several topics for new research to help learning in this area, including training for NRMR IE practitioners on various designs (CONSORT, experimental, longitudinal and using surveys) and use of participatory evaluation and transforming narratives into information. This led to a discussion on possible capacity building for IE across CRPs and what needs to be clear within the COP in order to undertake this task; for example, using a set of criteria as a recipe will not work.

The second presentation, by David Pearce of CIE, focused on their learning from valuing environmental impacts in NRMR, which is a key area of opportunity for ACIAR IA methodological development. The learning was based on the Murray Darling Basin Plan in Australia, using an ecosystems services framework to illustrate the types of R&D impacts involved in valuation. In the discussion, the group related how the ecosystems services framework points to the need to include valuation of environmental impacts within TOC in NRMR. It was pointed out that this valuation can help legitimize an evaluation approach even if value is not always generated, since it allows us to think through uncertainty and acknowledge it.

This led to a discussion around the need to couch this approach within wider social processes, and the group agreed that the process of valuation is more important than the number that may be produced, while it was acknowledged that the number is sometimes the main focus for policymakers. The process can be a collective TOC approach to doing IE in NRMR, and ecosystems valuation is a potentially useful methodology within this approach.

From the agreement reached on the framework, the group discussed how to use a multiplicity of methods under the TOC approach, which can help bridge accountability with learning in IE. The group generated a list of opportunities for methodological development. The list is shown in Box 2 below; however, it was noted that a prioritized list is needed to focus specific efforts on methodological development.

Box 2. Opportunities for methods development.

1. Non-market valuation approaches.
2. Methods that introduce uncertainty in both the specifications of the model and its specific biophysical changes.
3. How to standardize quantification of qualitative information.
4. How to refine case study methodology to make it more legitimate from the perspective of stakeholders.
5. Determining appropriate combinations of quantitative and qualitative methods for IE of NRMR.
6. Determining the best method for each type of NRMR program/project and the remaining gaps.
7. Methods to measure unexpected outcomes and/or impacts.
8. Quantitative modeling that incorporates complexity (e.g., agent-based modeling).
9. Participatory action research methods to capture our research process.
10. What indicators can characterize/measure outcomes at different scales (in particular, at 'high' levels) and how to infer resulting impacts.
11. How to evaluate networking/partnerships.
12. Methods to evaluate collaborative research.
13. Methods that seek to identify and measure process outcomes of our research.
14. Methods to evaluate the proposition that a 'bigger' project is better value than multiple, 'smaller' projects.

Objective: Develop an action plan for strengthening NRMR IE in participating CRPs

The final workshop session focused on defining and agreeing upon the next steps the group should take to build towards an action plan for strengthening NRMR IE. The following steps were agreed upon:

1. Development of the SRA into a full proposal.
2. A workshop report to be completed and shared.
3. A proposal for a communication strategy for the position paper.
4. Ideas for inter-CRP collaboration on capacity building.
5. Presentation of the AAS approach to IE to EIARD.
6. Sharing IDOs with other CRPs.

The first step was taken the following day through a meeting between ACIAR, CSIRO and WorldFish to discuss SRA progress. The meeting helped clarify what needs to be done under the final SRA activity to produce a proposal for follow-up work on methodological development for the NRMR IE developed through this first grant. CSIRO agreed to provide input into the proposal through focusing a literature review on the following prioritized methods opportunities:

- Methods that introduce uncertainty in both the specifications of the model and its specific biophysical changes.
- Quantitative modeling that incorporates complexity (e.g., agent-based modeling).
- How to standardize quantification of qualitative information.
- How to evaluate networking/partnerships.
- What indicators can characterize/measure outcomes at different scales (in particular, at 'high' levels) and infer resulting impacts.

Progress towards Steps 3 and 4 was made by Boru Douthwaite and Javier Ekboir in a post-workshop meeting.

The capacity-building process is also supported through ongoing collaboration among CRPs, such as through sharing development of IDOs (Step 6) as the CGIAR continues to identify and define CRP IDOs. Boru Douthwaite will prepare for Step 5 by sharing the presentation outline with the group beforehand.

This workshop report is the output of Step 2.

V. Annexes

Annex 1: Participants

	Name	Institution
1.	John Mayne	Independent Consultant
2.	Brian Belcher	CRP Forests and Trees/CIFOR
3.	Elliot Stern	Independent Consultant
4.	Marina Apgar	CRP Aquatic Agricultural Systems/ WorldFish
5.	Javier Ekboir	Institutional Learning and Change
6.	David Pearce	Center for International Economics
7.	Boru Douthwaite	CRP Aquatic Agricultural Systems/ WorldFish
8.	Charles Criss-man	CRP Aquatic Agricultural Systems/ WorldFish
9.	Ross Darnell	CSIRO
10.	Khondker Murshed-E-Jahan	WorldFish – Bangladesh

Annex 2: NRMR program attributes and their implications for evaluation design

Attributes	Evaluation Challenge	Design Implications
1. *Complex ecosystem interactions mediating social and ecological systems relationship*	Traditional (non-NRMR) evaluations are often able to simplify the role of ecosystems in defining the impact of particular research. In the case of NRMR, however, these ecosystem interactions are likely to be crucial to the means by which the research has an impact, the nature of that impact, the magnitude of the impact, the causality involved, and the stability (or longevity) of the impact. Ecosystems are often subject to complex, non-linear and threshold-driven responses to particular interventions.	This has substantive implications for the TOC underlying the evaluation, the understanding of causality in the system (even the conventional 'counterfactual' approach becomes more complex here), the nature of data collections and the role that explicit analysis of uncertainty needs to play in the evaluation. One essential challenge will be to incorporate the scientific knowledge of many relevant disciplines in the evaluation process.
2. *Frequent absence of market-based coordination of activities around the use (and conflict resolution in that use) of natural resources*	In traditional (non-NRMR) evaluations, market prices (appropriately interpreted) often form the starting point for estimating value. The absence of markets (and in some cases associated property rights) provides a challenge to valuation and the processes by which research outputs are adopted (market prices being a common signal to adoption in many other forms of research).	Evaluation design needs to account for the ways in which property rights over resources have been traditionally defined and the associated 'institutions' that mediated resource use in the communities affected. Put another way, NRMR will take place within an existing complex dynamic of methods for resolving resource use issues. A range of different forms of data collection will be needed. Participatory approaches and understandings of collective responses may become relatively more important.
3. *Multi-stakeholder participation and coordinated action in socio-ecological systems*	Multiple stakeholders and beneficiaries need to coordinate their behaviors and policies in order to implement programs and to sustain impacts in socio-ecological systems. The processes of achieving collective action, as well as the outcomes, need to be evaluated.	The evaluation will require inputs from beneficiaries and stakeholders. Methods that evaluate collective action are also needed—probably (following Poteete, Janssen and Ostrom 2010) focusing on trust, informal relationships, networks, incentives, information and ownership. The challenge will be to link these processes to the sustainability of non-material outcomes, such as new forms of governance and their value for conflict resolution.
4. *Multi-leveled (operating at farm, landscape, regional and global level)*	In multi-leveled programs with social-ecological interactions across scales, the outcomes and impacts at each level have to be evaluated with appropriate methods for each level, as well as aggregating for global-level impacts.	A 'nested' design deploying methods appropriate to each level will be needed. This could include different theories of change at different levels: a comparative or experimental design at farm level, comparative case studies at landscape level, and a statistical analysis at regional and global levels. Understanding the links between these different levels may require a further set of 'systems' designs, including modeling.
5. *5. Uncertain, variable and interacting trajectories for impact*	Due to the interaction between social and ecological systems, NRMR programs deal with huge variations in the impact trajectories of the systems they engage in. Further, implementation trajectory changes need to be tracked rather than assessed at a single moment in time.	Tracking change over time is likely to require non-standard monitoring and evaluation approaches. These could include longitudinal methods—e.g., longitudinal case studies, panels, time series data, etc. There will also need to be opportunities to revise initially formulated theories of change.
6. *Systems integration required for resilience and sustainability (related to 4 and 5)*	NRMR programs often combine research on genetic technologies and farming systems/ institutions together with assessments of environmental and livelihood consequences. The success of NRMR is often understood as trade-offs between production, environmental and social effects. For sustainability, a holistic approach is required to see the longer-term impacts for resilience and sustainability.	A balanced evaluation will need to address how all the elements are combined—there is a tendency to focus on one element only. Framing in terms of 'innovation systems' may be appropriate; so will methods and models that assess trade-offs and can provide holistic understanding.

7. *Contextualized knowledge is vital*	NRMR programs are often place-based, focusing on a particular ecosystem and population interacting with it. Different 'starting conditions' will shape the implementation and potential results of programs. Contextual characteristics may also include history of prior initiatives. Challenges arise in evaluating how generalizable and replicable the program is.	Even though contexts are not standardized, they are likely to fall into certain types. Contexts should therefore be clustered into typologies to achieve limited generalization—a strength of using 'realist' evaluation approaches. This also implies building a comparative element into program selection and design. When the elicitation of local knowledge is critical, assessing the elicitation process and how this knowledge informs design and implementation will be important. Knowledge elicitation usually depends on participatory engagement and developing models (as for expert systems). Local histories will be useful to identify previous related initiatives and endogenous developments.
8. *Unpredictability and emergent outcomes (related to 6)*	The complex interactions of social and ecological systems in NRMR mean that outcomes cannot be predicted. The challenge is to be able to capture the unexpected outcomes and impact.	For elements of interventions where this is the case, designs built on developmental approaches (Patton 2011) and use of real-time evaluation with frequent feedback is needed to learn what is happening.
9. *Operates in areas of limited/little prior or reliable knowledge*	NRMR research programs operate on scientific frontiers. New knowledge is an important output of NRMR and is equally important to make 'impact' more likely.	Baseline efforts to systematize existing knowledge and 'knowledge in use' should be followed through with tracing the use of new knowledge in practice by different stakeholders. The evolving knowledge base partly explains why not all decisions about evaluation design can be taken at the outset, reinforcing the need for an iterative or staged evaluation design.
10. Institutional concerns	Changes are expected not only in individuals but in institutions.	Include institutions relevant to system change from the outset. Pay particular attention to barriers to sustainability, and conduct repeat case studies at critical junctures in the implementation process.

VII. Acronyms

ACIAR	Australian Center for International Agricultural Research
AAS	Aquatic Agricultural Systems
CCAFS	Climate Change Agriculture and Food Security
CGIAR	A global research partnership for a food secure future
CIE	Center for International Economics
COP	Community of Practice
CRP	CGIAR Research Program
CSIRO	Commonwealth Scientific and Industrial Research Organization
EIARD	European Initiative on Agricultural Research for Development
IA	Impact Assessment
IDOs	Intermediate Development Outcomes
IE	Impact Evaluation
ILAC	Institutional Learning and Change Initiative
MEIA	Monitoring, Evaluation and Impact Assessment
M&E	Monitoring and Evaluation
NRMR	Natural Resources Management Research
RCTs	Randomized Control Trials
RinD	Research in Development
SLOs	System-Level Outcomes
SRA	Small Research and Development Activity
TOC	Theory of Change

With communities, changing lives

This publication should be cited as: CGIAR Research Program on Aquatic Agricultural Systems. (2012) Strengthening Impact Evaluation in Natural Resource Management Workshop Report, 4-5 September 2012, Penang, Malaysia. CGIAR Research Program on Aquatic Agricultural Systems. Penang, Malaysia. Workshop Report: AAS-2012-22.

The CGIAR Research Program on Aquatic Agricultural Systems is a multi-year research initiative launched in July 2011. It is designed to pursue community-based approaches to agricultural research and development that target the poorest and most vulnerable rural households in aquatic agricultural systems. Led by WorldFish, a member of the CGIAR Consortium, the program is partnering with diverse organizations working at local, national and global levels to help achieve impacts at scale. For more information, visit aas.cgiar.org.

Design and layout: Eight Seconds Sdn Bhd.

Printed on 100% recycled paper.

Photo credits: Front cover, Georgina Smith; back cover, Samuel Stacey.

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