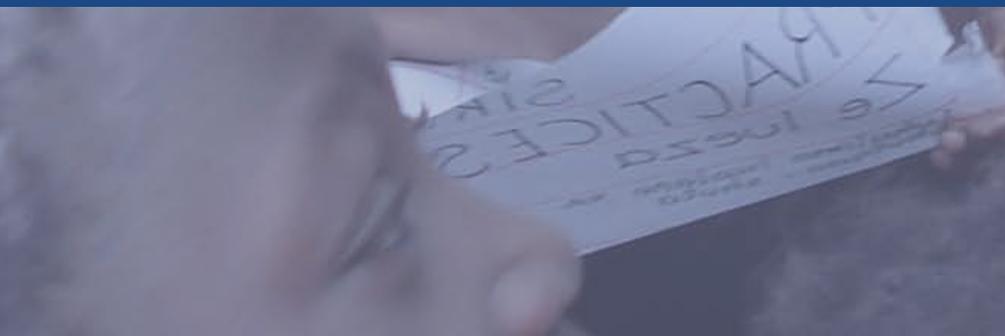




Practice Brief: AAS-2013-23

AAS Practice Brief: Evaluating natural resource management programs



RESEARCH
PROGRAM ON
Aquatic
Agricultural
Systems

AAS Practice Brief: Evaluating natural resource management programs

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Brief points

- Natural resource management research (NRMR) programs are complex, involving multiple interventions, actors, levels, and locations; the need to integrate social, environmental, and economic systems; and emerging understanding of the pathways to results.
- Credibly linking NRMR actions with intended benefits in terms of reduced poverty, enhanced nutrition, and increased food security and sustainable development poses significant challenges.
- Using impact pathways and theories of change with monitoring and evaluation can help guide implementation of NRMR programs over time and demonstrate that NRMR actions have made a difference:
 - Participatory monitoring of early and emerging results and pathways can provide a basis for adaptively managing the program.
 - Evaluation can explore if the program is making a difference by verifying expected theories of change, assessing the extent to which the NRMR program is a contributory cause.
- A variety of evaluation approaches are possible. They need to take into account the attributes of the NRMR program, the evaluation questions of interest, and the available evaluation designs and data collection methods.

The complexity of NRMR programs

Natural resource management research (NRMR) has a key role in improving food security and reducing poverty and malnutrition in environmentally sustainable ways, especially in rural communities in the developing world. Demonstrating this through impact evaluation poses distinct challenges. This Practice Brief discusses ways in which these challenges can be addressed. The full report can be found in Mayne and Stern (2013).

NRMR combines technological innovation with real-world changes in agricultural practice that involve many stakeholders at farm, community, scientific, and policy-making levels. These programs seek to integrate multiple inputs or interventions—scientific, institutional, human, and environmental; to actively engage with beneficiaries and other implicated parties; and to mobilize stakeholders, both to support innovative programs and to carry forward lessons learned into the future.

NRMR programs are complex. They can be described by ten key attributes:

1. *System interconnectedness*: complex ecosystem interactions mediating relationships within social and ecological systems.
2. *Market failure*: frequent absence of market-based coordination of activities around the use (and conflict resolution in that use) of natural resources.
3. *Multiple stakeholders*: multi-stakeholder participation and coordinated action in socio-ecological systems.
4. *Multi-leveled*: operating at multiple levels (farm, landscape, regional, and global)—often quite localized interventions are seen as contributing to more ambitious goals at a higher system level.
5. *Uncertain, lengthy trajectories for impact*: a time-extended and uncertain developmental trajectory; also, market variables can change very fast, while landscape variables usually change over decades.
6. *Systems integration*: interconnectedness and integration among different fields of knowledge, such as farm productivity, institutional innovation, and environmental concerns—between which there is often a trade-off.
7. *Contextualized knowledge*: a high level of contextualization—the specific context and history matter.
8. *Emerging outcomes*: the likelihood that new systems leading to unpredicted outcomes will arise as existing NRMR system elements interact.

9. *Uncertain knowledge*: operating in areas of limited/little prior or reliable knowledge.

10. *Institutional aspects commonplace*: impacts are often institutional—such as in governance and markets.

As a result of these factors, causal attribution of productivity and livelihood benefits to NRMR interventions is difficult when NRMR itself is part of a “package” of different actions adapted to diverse and changing settings by farmers and other stakeholders, often over extended time periods.

NRMR as a contributory cause

It seems clear that NRMR is likely to be a contributory cause rather than the sole cause of any observed benefits. Change is nearly always the result of a causal package of factors, and for an NRMR program to make a contribution, it must be a necessary part of the package. The causal package is the set of all the causal factors that are sufficient to bring about the desired results (outputs, outcomes, and impacts). The NRMR program can be said to have *made a difference* if it can be shown to have been a contributory cause (Mayne 2012); that is, the causal package with the intervention was sufficient and the intervention was an essential element of the package.

Impact evaluation of NRMR programs should be seen as contributing to an adaptive learning process that supports the successful implementation of innovative programs. This contrasts with an impact assessment perspective that is often mainly concerned with forms of accountability that measure and attribute impacts to particular programs or interventions. Starting from a learning perspective, impact evaluation can still address accountability by demonstrating that NRMR programs make a difference by contributing to results, while also improving performance through continuous learning.

The importance of impact pathways and theories of change

A key evaluation focus is on the causal links between NRMR program activities and the sequence of subsequent intended results. As these programs are expected to produce generalized solutions that can be replicated and scaled up to tackle regional or even global problems, evaluation also has to be able to explain why and under what circumstances programs are effective. This is why the proposed evaluation strategy includes approaches to explanation, and why impact pathways (Douthwaite, Alvarez, Thiele, and Mackay 2008) and theories of change are an essential part of the proposed approach. Impact pathways describe results chains, showing the linkages between the sequence of results in getting to impact. A theory of change adds to impact pathways by describing the assumptions behind the causal linkages—what has to happen for the causal linkages to be realized.

Theories of change model the intervention as a contributory cause; that is, they set out models of how the intervention is expected to contribute to the desired results. Theories of change not only incorporate causal packages but also set out the expected relationships between the intervention and the supporting factors (assumptions), as well as identifying the risks (confounding factors). Confirming that an NRMR theory of change is working as expected demonstrates that the intervention was a contributory cause.

Ideally, a theory of change is developed when a program is being designed, revised on an ongoing basis as understanding and events unfold through monitoring, and used as a key element in the design of any evaluation. The theory of change should incorporate the perspectives of key stakeholders, beneficiaries, prior evaluations, and the existing relevant research on the substantive area.

Developing a theory of change for an NRMR program is useful for several reasons:

- Ex ante, a theory of change can help design the program intervention and identify indicators for monitoring. A theory of change can also be used to assess the likelihood that the intervention will be successful.
- Reviewed periodically, a theory of change assists in assessing progress and in delivery adjustments—it is a tool for adaptive management.
- When reviewed at the time of an evaluation, a theory of change feeds into the design of tools for the evaluation, such as surveys and interview guides, and can be used as the basis for understanding, making causal claims about the program, and generalizing.
- Used as a basis for reporting, a theory of change can provide a framework for telling a credible performance story.

The use of theories of change in development evaluations has been reviewed by James (2011), Vogel (2012), and Stein and Valters (2012).

An indicative theory of change for NRMR programs

Figure 1 shows an indicative theory of change for NRMR programs, and within it a number of nested (sub-)theories of change. The main theory of change for the NRMR program is the sequence of events and conditions that affect the intended beneficiaries—the farmers and fishers. This *beneficiary theory of change* is spelled out in a little more detail in the figure, with an indication of the kinds of key assumptions (supporting factors) needed for increased productivity to occur. This in turn is intended to lead to broader increased food security, reduced rural poverty,

reduced malnutrition, and more sustainable management of natural resources through scaling out and up.

The other major outcomes, such as new or improved policies, institutions, governance arrangements, markets, and social norms, are shown here as supporting factors—the enabling environment. They are not ends in themselves but activities needed to sustain results at the farm level and to scale up results to the community and regional levels. They are arrived at through research and engagement with key partners, and for each there could be a nested theory of change.

It follows that key features of a theory of change for an NRMR program will include the following:

- A program-level NRMR theory of change that is indicative of the big picture theory behind the program, and is useful in communicating and clarifying program strategy.
- A number of nested sub-theories of change around different intervention strategies and/or different target groups operating at different levels. For example, the Aquatic Agricultural Systems (AAS) program works at three levels—program, hub, and project—and theories of change are likely needed at each level. Nested sub-theories of change for the range of engagement activities with partners are an essential element of NRMR theories of change. They capture how the interventions are expected to work at different levels of implementation, and how each intervention is expected to work with different actors.
- The underlying assumptions—the supporting factors—in the overall intervention causal package as part of the theory of change. This builds on the perspective that NRMR interventions are contributory causes.
- A results trajectory running through NRMR theories of change that is unlikely to be linear in either time or direction.

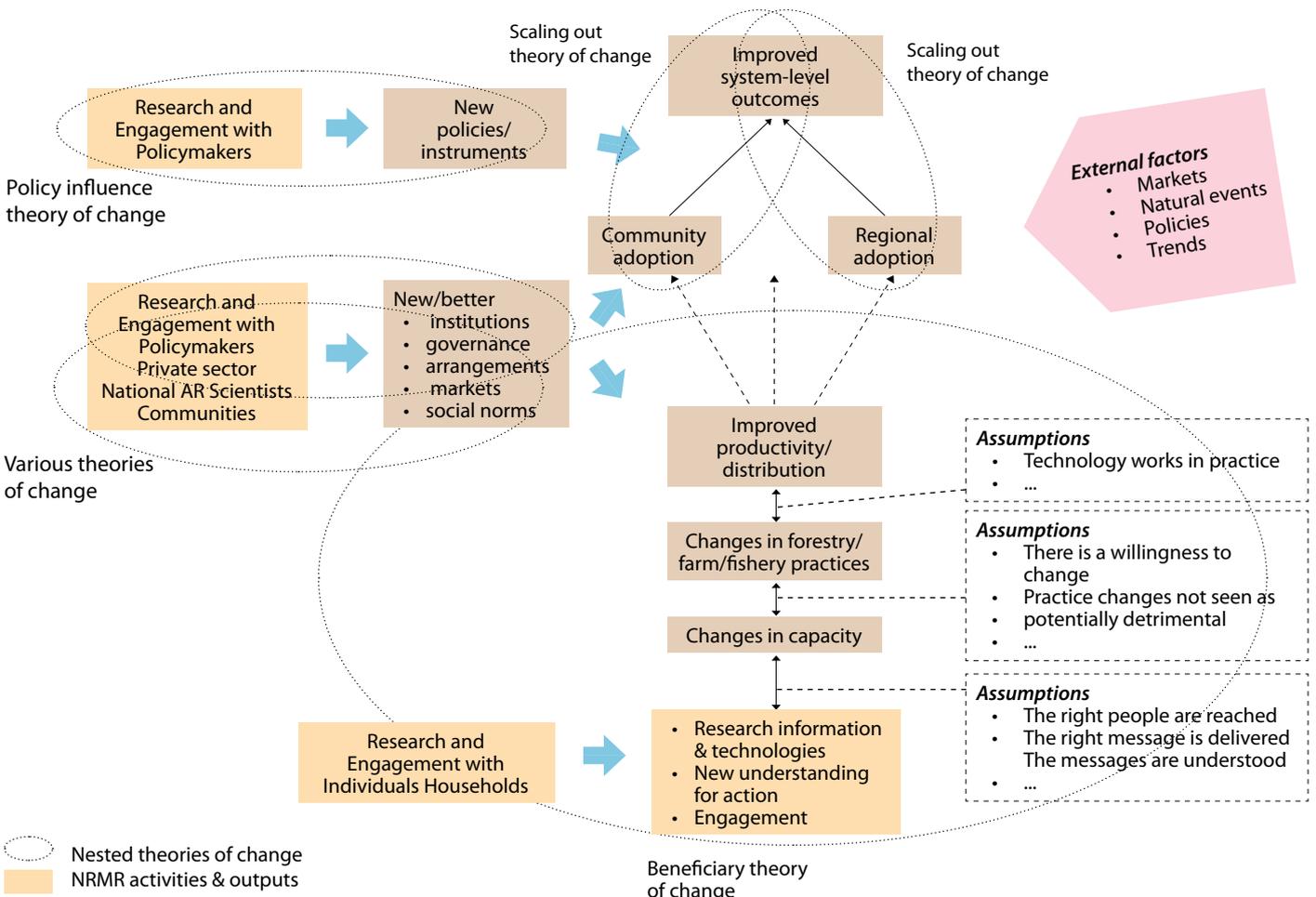


Figure 1. An Indicative Theory of Change for NRMR Programs.

Issues in evaluation of NRMR programs

When to evaluate? Despite the long time frame for expected development results from NRMR, often 10–15 years, most impact evaluations and impact assessments occur at an early stage in the process. The challenge of when to evaluate partly depends on what is being evaluated and for what purpose—some evaluations will be prospective, some early in a program cycle, and some a few or many years later.

It may not be useful to think of impact evaluation as an evaluation at one point in time. Continuous monitoring should be seen as an essential element of the evaluation package, providing data for evaluation and for adjustments to implementation. Further, the more complex the setting, the more useful it will be to look to more real-time evaluation approaches that gather and analyze data on a regular basis, perhaps through special studies or as part of monitoring. In this perspective, evaluation is an ongoing process, which can still include impact evaluation or impact assessments at appropriate points in time.

What to evaluate? Given the complexity of an NRMR program in terms of its many components, some thought is needed as to what to evaluate. Projects are a frequently used unit of analysis, but it can often be more useful to consider:

- Impacts on spatial areas or population target groups or research partners,
- Specific results from different types of intervention strategies within the program, and/or
- How different intermediate outcomes were brought about.

Selecting evaluation approaches

In general, selecting an evaluation approach depends on the following:

1. The evaluation questions that are to be addressed.
2. The characteristics and attributes of the context and program being evaluated.
3. The available evaluation designs and methods.

The figure below from Stern et al. (2012)—also reproduced in Mayne and Stern (2013)—illustrates this framework.

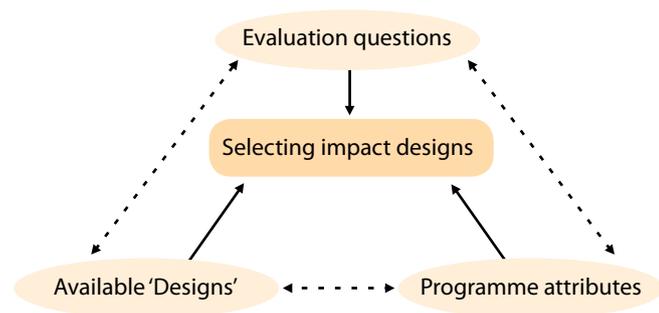


Figure 2. Framework for Evaluation

Getting the evaluation questions right

An evaluation should begin with appropriate evaluation questions that interest program staff, policy makers, donors, and other stakeholders. In complex settings this is particularly important. Key evaluation questions should be about what difference the program is making (i.e., the contribution being made), about understanding the progress being made and why results are occurring, and about the learning occurring. A framework for defining evaluation questions is suggested in Box 1.

Box 1. A framework for Evaluation Questions.

Ex ante:

1. Should the intervention work?

Ex post:

1. Should the intervention still work?
2. Has implementation worked?
3. Did the intervention work?
4. How and why does the intervention work?
5. Will the intervention continue to work?
6. Will the intervention work elsewhere?

Attributes of NRMR programs

The key attributes of NRMR programs provide challenges to both managing and evaluating programs. This reality needs to be taken into account when developing an evaluation plan. For example, the complex ecosystem characteristics of NRMR combine ecological and social systems, which affects what impacts can be measured and how. An evaluation design for such ecosystems will also need to integrate different kinds of scientific knowledge—for example, knowledge related to crop science, economic analysis of markets, and institutional governance. NRMR programs are also often place-based, focusing on particular populations with particular ecological histories. Understanding contexts is therefore vital when evaluating such programs, and context-sensitive analytic frameworks will be needed. These connections between the attributes of programs and evaluation designs are further elaborated in Table 1 in the Annex to this Practice Brief.

Designs for NRMR evaluations

A broad range of different evaluation designs and methods can be considered, including theory-based, case-based, and participatory approaches. Although not specifically discussed here, more traditional approaches such as experimental and statistical methods should not be dismissed—they will often be valuable as part of an overall evaluation strategy. Ultimately the selection of designs and methods will follow from the kind of evaluation questions being asked—and these questions will be distinctive for a learning-focused impact evaluation. For example, evaluations are likely to seek to answer questions about the implementation process—how implementation contributes to results, and which implementation lessons are case-specific and which could potentially be transferred. In order to replicate and scale up, the evaluation needs to ask questions about whether an intervention or program will work elsewhere. This requires that methods suited to clarifying generalizability should be overlaid onto case-specific experience. Table 2 in the Annex to this Practice Brief summarizes the relationships between evaluation questions and evaluation tools, methods, and designs.

A general framework for evaluating NRMR programs

Evaluation in complex settings requires attention to both the evaluation design and to ongoing monitoring. A good monitoring system is essential in order to detect and track emerging outcomes and pathways that may not be predicted by the program theory of change.

Given the nature of NRMR programs, the monitoring and the evaluation plans should be developed together with stakeholders, beneficiaries, and others implicated; be validated by stakeholders; and offer flexibility for revision and redirection. The following planning and design activities will usually be needed to prepare the evaluation and monitoring frameworks.

Clarifying evaluation and monitoring purposes

- Review the strategic interests of program stakeholders, including beneficiaries and program sponsors.
- Consider the purposes and uses of the evaluation and monitoring, and who the users will be.
- Identify the main evaluation and monitoring questions that program implementers, beneficiaries, and other stakeholders are interested in answering. These are likely to cover both intended program results and related implementation processes.
- Clarify the balance and priority to be given to the impact aspects of the evaluation; that is, both causal and explanatory dimensions.

Identifying program characteristics

- Review the distinctive NRMR aspects of the program, and where appropriate, propose which aspects should be prioritized.
- Assess the attributes and priorities of the program and consider the implications these have for evaluation strategy, methodology, and data access.
- Identify and map overlapping or related programs (e.g., those that have related goals and affect the same target groups and territories).
- Identify possible losers as well as beneficiaries.
- Conduct an ethical assessment of the evaluation—confidentiality risks, effects for the less powerful, perverse incentives and moral hazards, feedback obligations, and how stakeholders and others implicated will have voice.

Elaborating an initial theory of change

- Posit an initial implementation and outcome trajectory in terms of shape (speed and extent) and time.
- Decide on an appropriate time-slicing of the monitoring and evaluation activities (what happens when), paying special attention to the first stages of an evaluation and the first iteration of activities that will be needed.
- Develop an initial overarching theory of change. This should draw on assumptions and goals of stakeholders, program implementers, beneficiaries, and others; feasibility and planning data; and other related experience—published sources, practitioner experience, other evaluations, etc.
- Attempt a first-round outline of the main nested evaluation elements at different system levels, as well as elements that link different levels.

Reviewing data availability and quality

- Review available data sources, paying particular attention to data gaps and weaknesses.
- Design monitoring systems that will track change and fill in data gaps identified.
- Specify a quality assurance plan that will ensure evaluator independence, ethical monitoring, data quality, and methodological rigor.

With this input, an *NRMR evaluation plan integrated with a learning-oriented and adaptive management plan* would entail the following:

- Identifying the program's theoretical assumptions and developing its indicative theory of change.
- Developing key nested theories of change within this overall theory of change.
- Identifying which data could be usefully gathered by management on an ongoing basis so that early outcomes in terms of capacity and behavioral changes and emerging outcomes could be tracked.
- Putting in place a routine process for adaptive management, so that as the pathways to outcomes and emerging outcomes become clearer through monitoring,

appropriate changes can be made to the implementation of the program.

The NRMR *evaluation framework* would indicate the following:

- The main evaluation priorities and evaluation questions.
- Specific evaluative activities (additional data collection, analysis, drawing conclusions and recommendations, reporting, etc.) and when these should take place.
- The evaluation design to be used to explain the results observed (outputs, outcomes, and impacts).
- The division of labor between evaluators, managers, beneficiaries/those implicated, and other stakeholders
- A quality assurance and ethical set of standards and procedures.

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Annex

Linking Evaluation Designs With Program Attributes and Evaluation Questions

Evaluation designs and attributes

Table 1 outlines and discusses possible implications for evaluation designs to deal with the ten attributes of NRMR programs.

Table 1. NRMR Program Attributes and Evaluation Designs.

Attribute	Evaluation challenge	Design implications
1. <i>Complex ecosystem interactions mediating relationships among social and ecological systems</i>	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, nonlinear, and threshold-driven responses to particular interventions.	This has substantive implications for the theory of change 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 overriding challenge will be to incorporate the scientific knowledge of many relevant disciplines in the evaluation process.
2. <i>Frequent absence of market-based coordination of activities around the use (and conflict resolution in that use) of natural resources</i>	In traditional evaluations, market prices 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, since market prices are a common signal of 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 understanding of collective responses may become relatively more important.
3. <i>Multi-stakeholder participation and coordinated action in socio-ecological systems</i>	Multiple stakeholders and beneficiaries need to coordinate their behaviors and policies 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 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. <i>Multilevel (operating at farm, landscape, regional, and global levels)</i>	In multilevel programs with socio-ecological interactions across scales, the outcomes and impacts at each level have to be evaluated with appropriate methods for that level as well as aggregating for global-level impacts.	A nested design deploying methods appropriate to each level will be needed. For example, 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. <i>Uncertain, variable, and interacting trajectories for impact</i>	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. Furthermore, 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.

Attribute	Evaluation challenge	Design implications
6. <i>Systems integration required for resilience and sustainability (related to 4 and 5)</i>	NRMR programs often combine research on genetic technologies and farming systems/institutions with assessments of environmental and livelihood consequences. Success is often understood in terms of 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 assess 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 too will be methods and models that assess trade-offs and can provide holistic understanding.
7. <i>Contextualized knowledge is vital</i>	NRMR programs are often place-based, focusing on a particular ecosystem and the population interacting with it. Different starting conditions will shape the implementation and potential results of programs. Contextual characteristics may also include the history of previous 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 (Pawson and Tilley 2006). 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. This usually depends on participatory engagement and model development (as for expert systems). Local histories will be useful for identifying previous related initiatives and endogenous developments.
8. <i>Unpredictability and emergent outcomes (related to 6)</i>	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 monitoring and real-time evaluation with frequent feedback are needed to learn what is happening.
9. <i>Operates in areas of limited/little previous or reliable knowledge</i>	NRMR 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. <i>Institutional concerns</i>	Changes are expected not only in individuals but also 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.

Overall evaluation designs and impact evaluation questions

Table 2 summarizes the relationships between evaluation questions and the evaluation tools, methods, and designs for use in learning-focused impact evaluations.

Table 2. Summary of Tools, Methods, and Design Implications for Impact Evaluation Questions.

Key Evaluation Question	Related Evaluation Questions	Underlying Assumptions and Requirements	Suitable Tools, Methods, and Designs
Is the rationale for the intervention and its design still sound?	<p>To what extent are the goals of the program still relevant?</p> <p>Does the program design and implementation continue to be realistic and supported by current evidence and practice? Is the theory of change still sensible?</p> <p>Are there alternative strategies that should now be used?</p>	<p>The program comprises a coherent set of activities with common aims.</p>	<p>Surveys/interviews.</p> <p>Document review.</p> <p>Literature review.</p> <p>Context analysis.</p> <p>Logical analysis (Brousselle and Champagne 2011).</p>
What has been learned about implementation?	<p>What has been learned about how the NRMR program has been implemented?</p> <p>How has the implementation contributed to the results?</p> <p>Can implementation lessons learned be transferred elsewhere?</p>	<p>There was a strategy behind implementation.</p> <p>Implementation was modified as circumstances and understanding changed.</p>	<p>Surveys/interviews.</p> <p>Document review.</p> <p>Literature review.</p> <p>Context analysis.</p> <p>Logical analysis.</p>
What results have been realized?	<p>What outputs have been delivered?</p> <p>What related outcomes have been observed?</p> <p>What related impacts have been observed?</p>	<p>Different levels of results can be reliably specified and measured.</p> <p>Emerging results were monitored.</p>	<p>Surveys/interviews.</p> <p>Document review.</p> <p>Database review.</p> <p>Observations.</p> <p>Monitoring data.</p>
Has the intervention made a difference?	<p>Was the intervention likely a contributory cause?</p> <p>What role did the intervention play, such as a trigger and/or an ongoing support?</p>	<p>There are several relevant causal factors that need to be disentangled.</p> <p>Interventions are just one part of a causal package.</p> <p>Supporting factors can be identified.</p>	<p>Experimental and statistical designs.</p> <p>Theory-based evaluation designs; e.g., contribution analysis (Mayne 2008).</p> <p>Case-based comparable designs; e.g., qualitative comparative analysis (Befani, Ledermann, and Sager 2007).</p>
How and why has the intervention made a difference?	<p>How have the impacts come about?</p> <p>For whom has the intervention made a difference?</p> <p>Has the intervention resulted in any unintended impacts?</p>	<p>Interventions interact with other causal factors.</p> <p>An adequate theory of change for the intervention can be developed.</p> <p>There is an understanding of how supporting and contextual factors connect interventions with effects.</p>	<p>Theory-based evaluation designs; e.g., "realist" approaches and contribution analysis.</p> <p>Participatory approaches.</p> <p>Case studies.</p>
Will the intervention continue to work?	<p>Are the intervention and its benefits sustainable?</p> <p>What are the future estimated benefits from the intervention?</p>	<p>The benefits from the intervention will continue to be realized.</p> <p>Future benefits can be reliably estimated.</p>	<p>Scenario approaches (Ling 2013).</p>

Key Evaluation Question	Related Evaluation Questions	Underlying Assumptions and Requirements	Underlying Assumptions and Requirements
<p>Will the intervention or elements of it work elsewhere?</p>	<p>Can this intervention as a pilot be transferred elsewhere and scaled up?</p> <p>Is the intervention sustainable?</p> <p>What generalizable lessons have we learned about impact?</p>	<p>There is generic understanding of contexts; e.g., typologies of context.</p> <p>Innovation diffusion mechanisms exist.</p>	<p>Participatory approaches.</p> <p>Natural experiments.</p> <p>Synthesis studies.</p> <p>Scenario studies.</p>



With communities, changing lives

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