

Chapter 4: When is Adaptive Management Successful?

Chapters 1 and 2 address the context and conditions for adaptive management to be applicable to resource management, and Chapter 3 describes adaptive management in operational and legal terms. In these chapters we referred to the successful implementation of adaptive management without ever explicitly defining success. Here we offer a definition, criteria, and steps to promote successful implementation.

4.1. Recognizing Success in Adaptive Management

In general, the implementation of adaptive management is defined as successful if progress is made toward achieving management goals through a learning-based (adaptive) decision process. This definition contains two essential elements. First, it requires progress toward achieving objectives, a primary indicator of success with any management strategy, whether adaptive or not. Second, it requires learning-based management, as

described in the nine-step operational sequence in Chapter 3. Specifically, stakeholder involvement, an effective monitoring program, and agreed-upon objectives, management alternatives, and models must be integrated into an iterative learning cycle (see Fig. 3.4). Of course, the decision making process must be framed in a context of applicable laws, authorities, and regulations.

Based on this definition, we suggest the following four criteria for recognizing success in adaptive management (Fig. 4.1):

- Stakeholders are actively involved and committed to the process.
- Progress is made toward achieving management objectives.
- Results from monitoring and assessment are used to adjust and improve management decisions.
- Implementation is consistent with applicable laws.

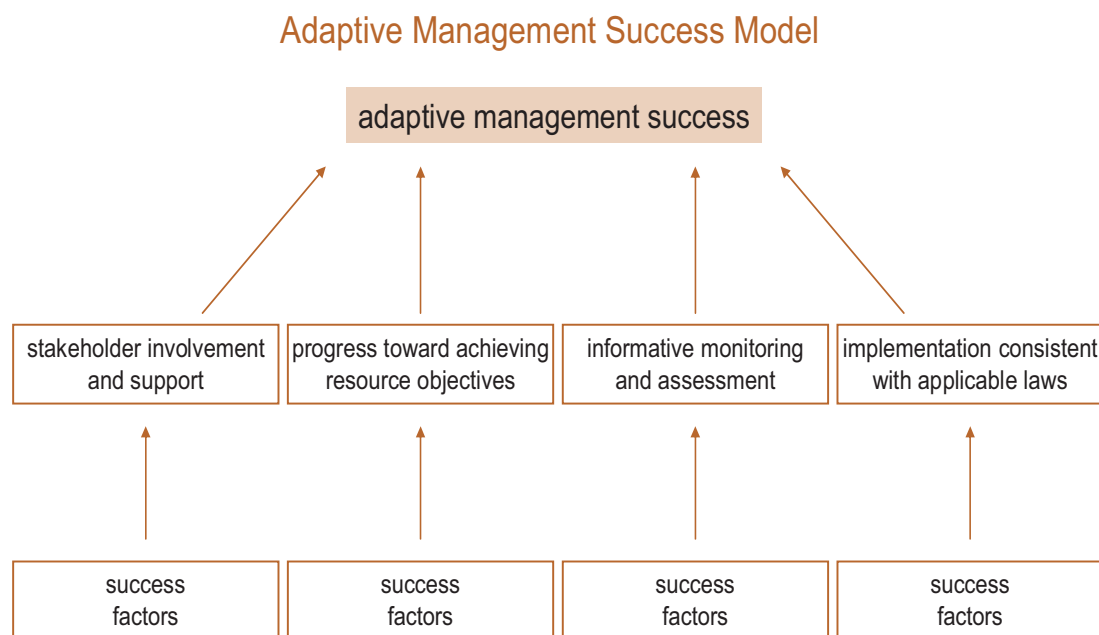


Figure 4.1. Adaptive management success model, with four success criteria. Success factors for each criterion are addressed by a series of questions that help practitioners increase the likelihood of success.

These criteria integrate the structural elements and processes described in the preceding chapters. They are interrelated and interdependent, and should be viewed collectively as indicators of success.

For an adaptive management project to be successful, all four criteria must be met over the project timeframe. For example, an adaptive management project is not considered fully successful if stakeholders do not see the resource management process as legitimate. Likewise, results from monitoring and assessments must be used to inform adjustments in management practices for it to be fully successful.

***Stakeholders are actively involved
and committed to the process***

Broad stakeholder involvement is critical for adaptive management success. Recall from Chapter 3 that engaging stakeholders is one of the key steps in adaptive management. Ideally, stakeholders are engaged in every aspect of adaptive management, from the initial problem formulation to the identification of objectives and the design of monitoring and assessment. The fact that stakeholders play a role in all aspects of the process argues for singling out stakeholder involvement as a key success criterion.

Including stakeholders in the adaptive management process reinforces stakeholder perceptions of adaptive management as a legitimate process, which in turn encourages cooperation and reduces the likelihood of conflict. Stakeholder involvement in problem identification, process design, monitoring and assessment, and other elements of the adaptive management process builds support for the process and provides a foundation for learning-based resource management. It also provides opportunities for resource managers to obtain additional information about the natural system and priorities for its management before decisions are made. Conversely, a lack of stakeholder involvement can by itself cause the process to fail.

***Progress is made toward achieving
management objectives***

In structured decision processes, clear and measurable objectives guide decision making and serve as metrics for assessing management performance. Because adaptive management by design pursues management benefits as expressed in the management objectives, progress toward achieving objectives is a natural criterion of success.

Two points about objectives are emphasized here. First, the objectives in natural resources management often are multidimensional, and thus involve tradeoffs. Improving an outcome associated with one objective may involve tradeoffs with outcomes associated with other objectives. When multiple management objectives are identified, it is important to recognize and account for the relationships among them, so that potential tradeoffs can inform decision making. In this way, consistent and achievable resource management goals and thresholds can be established.

Second, it is important to recognize that management objectives may change. In many cases, success in attaining objectives can be an ongoing process that involves refinement of objectives as understanding accumulates and stakeholder perspectives change. That is, the adaptive management system is itself dynamic, including its objectives. Adaptive management needs to include not only the cyclic evaluation of project performance, but also a periodic reassessment of the project objectives.

Results from monitoring and assessment are used to adjust and improve management decisions

The accumulation of understanding and subsequent adaptation of management strategy depends on feeding monitoring and assessment results back into the decision making process. Monitoring and assessment efforts should be designed to ensure that key resource parameters are adequately measured and appropriately focused, so as to contribute to achieving success. In Chapter 3 these key process elements were seen to factor directly into the operational sequence that defines adaptive management.

Here we emphasize the importance of monitoring resource responses and using the resulting information to assess system models, update their confidence measures, and reduce system uncertainty. Scientists, managers, and stakeholders should collaborate in an interdisciplinary assessment of what is known and what is learned about the system being managed. Success in adaptive management ultimately depends on effectively linking monitoring and assessment to objective-driven decision making.

Implementation is consistent with applicable laws

It is almost axiomatic that implementation of adaptive management must be consistent with applicable laws to be considered successful. The use of adaptive management in a manner that is not consistent with applicable laws will eventually lead to distractions from the project objectives, or to a breakdown in trust among stakeholders, or to a litany of official – and unofficial – sanctions.

Ensuring that an adaptive management application complies with applicable laws, regulations, and policies can be challenging because of the many legal considerations and complexities that may be involved. Thoughtful, detailed planning and constant attentiveness to the requirements of laws, regulations, and policies are needed to ensure the success of an adaptive management project.

This criterion should not be assessed in isolation. In large measure, success with the previous criteria will affect stakeholder assessments of whether an adaptive management project remains in compliance with applicable legal considerations. For example, if serious disagreements persist among stakeholders regarding the appropriateness of monitoring protocols and results, one or more of the stakeholders may challenge the validity of the program's results. This in turn can lead to withdrawal of stakeholder support, loss of continued funding, and even litigation.

Using the success model

A key success metric that adaptive management shares with all management strategies is progress toward the achievement of management objectives. As an adaptive management project moves forward in time, it should be possible to compare management performance against expectations, to get some idea of the progress made up to that time in achieving objectives. In the absence of at least some indication of progress over a reasonable period, there is little justification for continuing a project in its current form.

All four success criteria need to be met for successful implementation of adaptive management. They should be considered when initially developing an adaptive management project, and reviewed periodically over the life of the project to evaluate project implementation and assess the likelihood of achieving objectives. In fact, the success criteria can themselves be used adaptively, to determine where changes are needed in order to achieve success.

The success model provides a framework for both technical and process learning, as described in Section 3.1. The focus is on adaptation not only at the technical level, through an iterative application of decision making, monitoring, and assessment, but also at the institutional and process level, through periodic assessments of stakeholder perspectives, management objectives, and other process elements. The successful application of adaptive management potentially involves learning and adaptation at both levels. The following section includes questions that can be useful in implementing and evaluating the success of an adaptive management project.



Avian Influenza Sampling Project 2006



USGS scientist is measuring various water-quality conditions in Holes Creek at Huffman Park in Kettering, Ohio.

4.2. Key Questions for Successful Implementation

The following questions can be used to increase the likelihood of successful adaptive management, and to evaluate progress in achieving objectives. The questions address each of the criteria identified in Section 4.1 and are tied to the operational steps discussed in Section 3.1 and shown in Box 4.1. The questions should be considered throughout the timeframe of an adaptive management project, to ensure that success is continually considered and evaluated as the project progresses. A particular adaptive management project may not be able to address all of the issues outlined in the following questions. However, the questions encompass an important set of issues that should be considered, so as to increase the likelihood of success.

Box 4.1 Adaptive Management Operational Steps

Set-up phase

- ❖ *Step 1 - Stakeholder involvement*
Ensure stakeholder commitment to adaptively manage the enterprise for its duration
- ❖ *Step 2 - Objectives*
Identify clear, measurable, and agreed-upon management objectives to guide decision making and evaluate management effectiveness over time
- ❖ *Step 3 - Management actions*
Identify a set of potential management actions for decision making
- ❖ *Step 4 - Models*
Identify models that characterize different ideas (hypotheses) about how the system works
- ❖ *Step 5 - Monitoring plans*
Design and implement a monitoring plan to track resource status and other key resource attributes

Iterative phase

- ❖ *Step 6 - Decision making*
Select management actions based on management objectives, resource conditions, and enhanced understanding
- ❖ *Step 7 - Follow-up monitoring*
Use monitoring to track system responses to management actions
- ❖ *Step 8 - Assessment*
Improve understanding of resource dynamics by comparing predicted vs. observed change in resource status
- ❖ *Step 9 - Iteration*
Cycle back to Step 6 and, less frequently, to Step 1

Step 1- Stakeholder involvement

Two key aspects of stakeholder involvement are emphasized here. First, participation by stakeholders is essential if only because stakeholder perceptions of adaptive management as a legitimate process can promote cooperation and reduce the likelihood of conflict. Second, including stakeholders in the process provides opportunities for resource managers to obtain additional information about both the natural system and stakeholder values and priorities before decisions are made. Involving stakeholders builds support for the process and provides a foundation for learning-based resource management.

Key questions to consider when involving stakeholders in an adaptive management project include:

- Has a systematic process been developed that facilitates effective participation by stakeholders?
- Have key stakeholders been identified?
- Have agreed upon lines of communication been established and is their importance to successful adaptive management processes understood?
- Are stakeholders committed to and involved in the adaptive management process including the monitoring and assessment program?
- Is the adaptive management process able to adapt to changes in stakeholder and public viewpoints?

Step 2- Objectives

Objectives in adaptive management play important roles in decision making, evaluation, and learning. These roles are enhanced by the articulation of clear, measurable, and agreed-upon objectives. Because they can change through time as the resource system changes and stakeholder values evolve, it is useful to revisit objectives periodically.

Keeping the following questions in mind will increase the likelihood that decision making will be guided by resource management objectives:

- Have explicit and measurable management objectives been identified and developed?
- Are the management objectives achievable and sustainable?
- Have performance metrics relating to the management objectives been developed?
- Has a system of monitoring and assessment relevant to the management objectives been developed and implemented so that progress in meeting the objectives can be tracked?
- Have tradeoffs among management objectives been considered and are they understood?

Step 3- Management actions

The set of potential management actions determines the range of management flexibility for an adaptive project, and influences learning rates as well as progress in achieving management objectives. Learning is promoted by a wide range of management alternatives, but hampered by alternatives that differ only marginally. As with other components of an adaptive management project, the acceptable range of management options can change through time, as stakeholder perspectives and resource conditions evolve, legal requirements change, and new information becomes available.

Key questions about the set of management alternatives in an adaptive management project include the following:

- Has a range of potential management actions been developed?
- Have the specific tasks to implement the management alternatives been identified?
- Is the range of potential actions appropriate for the timeframe under which changes are likely to occur?
- Can the set of management alternatives be adjusted through time if needed?

Step 4- Models

Models serve as expressions of ecological understanding, as engines for deductive inference, and as articulations of resource response to management and environmental change. They also help bring together scientists, managers, and other stakeholders in a joint assessment of what is known about the system being managed, and facilitate an interdisciplinary approach to understanding through monitoring and assessment. It is important to keep the many roles of models in mind as an adaptive management project is implemented.

The following questions relate to the models used in an adaptive management project:

- Are the hypotheses underlying the strategies for resource management expressed as testable models?
- Have explicit links between management actions and resource dynamics been incorporated into the models?
- Are the ecological/resource processes that drive resource dynamics understood?
- Are the relevant environmental factors incorporated into the models?
- Are the models calibrated with available information?

Step 5- Monitoring plans

The use of objectives to guide decision making depends on linking monitoring and assessment results with the decision making process. Both monitoring and assessment should be designed to ensure that resource parameters are adequately measured and appropriately focused on relevant performance indicators. Effective and useful monitoring is required for the hypothesis testing that leads to the reduction of uncertainty that is key to adaptive management.

Important questions about the monitoring plan for an adaptive management project include the following:

- Will the monitoring plan support the testing of alternative models and measurement of progress toward accomplishing management objectives?
- Is it clear what monitoring data need to be collected to estimate the relevant resource attributes?
- Has the level of accuracy that is needed been identified?
- Are commitments among managers, scientists, and other stakeholders in place to sustain an ongoing monitoring and assessment program?
- Will meaningful and useful data and information be available within timeframes that allow for adaptive decision making?

Step 6- Decision making

An adaptive management strategy identifies actions at each point in time, with strategy implementation at a particular time based on resource status and understanding. The strategy typically evolves through time, as learning accumulates and the resource system responds to management actions.

Key questions about iterative decision making in an adaptive management project include the following:

- Is it clear how decisions will be made?
- Are decisions at each point in time based on the current status and understanding of the resource?
- Are decisions being guided by management objectives?
- Are stakeholders informed and consulted before decisions are made or changed?

Step 7- Follow-up monitoring

The effects of decision making are tracked with post-decision monitoring, and the data collected are used to gauge progress in meeting objectives and improve ecological understanding. Ideally, post-decision monitoring data can be folded into analysis/assessment before the next decision point, so that decision making at that time can take advantage of updated information and understanding.

Key questions about follow-up monitoring in an adaptive management project include the following:

- Are the analysis needs understood?
- Is monitoring conducted on a timely basis?
- Is monitoring targeted to system attributes that are useful for evaluation and learning?
- Are monitoring data collected and managed so that they are available and easy to access?
- Can the monitoring data be used to update the measures of model confidence?



Step 8- Assessment

The information from monitoring is used to evaluate management, improve understanding, and guide decision making. As noted in Chapter 3, these functions are promoted by the estimation of resource parameters and the comparison of these estimates against model-based predictions.

Key questions about analysis and assessment in an adaptive management project include the following:

- Have the expected impacts of alternative management strategies been evaluated?
- Is it clear how results are to be understood and interpreted?
- Have thresholds that indicate a change in management been recognized?
- Have the action(s) to be taken when a threshold is reached been identified?

Step 9- Iteration

The adaptive cycle of decision making, post-decision monitoring, and analysis/assessment (Fig. 3.3) leads to improved understanding as well as improved management. Periodic but less frequent cycling through the components of an adaptive management application (Fig. 3.4) allows for adjustments as stakeholder perspectives, institutional arrangement, and resource conditions evolve.

Key questions about iterative feedback in an adaptive management project include the following:

- Are management actions and decisions reviewed frequently based on monitoring and assessment?
- Have incentives been developed to encourage experimentation and learning?
- Have resource management alternatives been revisited and/or modified over time?
- Has uncertainty related to resource dynamics and the impacts of management actions been reduced through learning over time?

- Are the targets identified in the performance metrics likely to be achieved within the specified timeframe?

Legal considerations

Because of its scope and complexity, the legal framework for an adaptive management project can be confusing, and it is not always obvious to managers and practitioners which legal considerations to focus on. Among other things, this suggests the usefulness of engaging members of the DOI Solicitor's Office early on in an adaptive management project.

Key questions about legal considerations for an adaptive management project include the following:

- Are the applicable resource management laws and regulations understood by managers, scientists, and other stakeholders?
- Have steps been taken to comply with applicable laws and regulations?
- Has a process been developed to focus on compliance throughout the project life?
- Is the process in compliance with specific legal mandates?

4.2 Key Points

- ❖ Adaptive management allows managers to determine systematically whether management activities are succeeding or failing to achieve objectives.
- ❖ An adaptive management project is recognized as successful if (1) stakeholders are involved and committed to the process; (2) progress is made toward achieving management objectives; (3) results from monitoring and assessment are used to adjust management decisions; and (4) implementation is consistent with applicable laws.
- ❖ The implementation of adaptive management can be facilitated by considering a series of questions related to the success criteria and the operational steps.