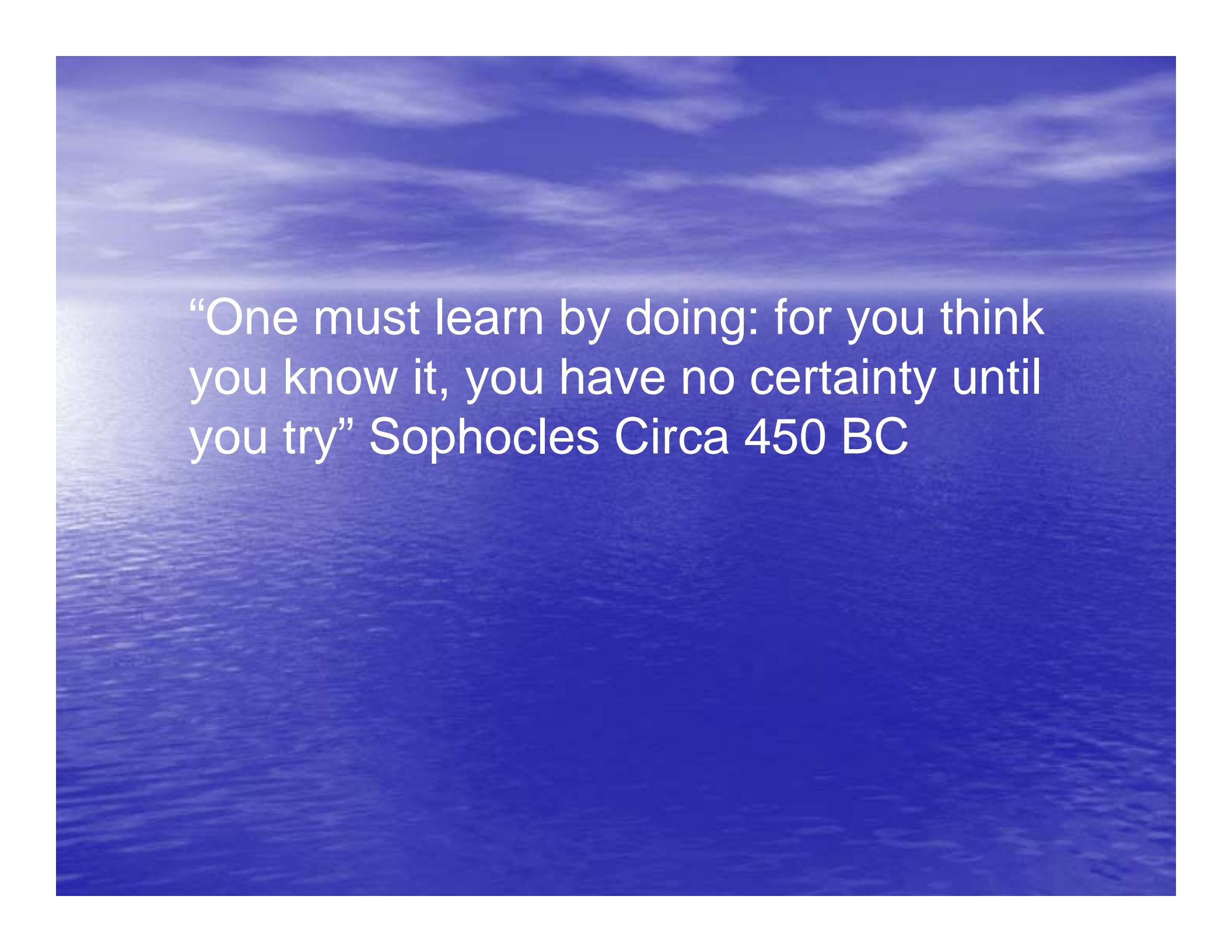


Adaptive Watershed Management

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“One must learn by doing: for you think you know it, you have no certainty until you try” Sophocles Circa 450 BC

Definition

- A process that integrates project design, management and monitoring to provide a framework for testing assumptions, adaptation and learning." (Source: IFAD Guide on Project M&E)

Management Objective

Today we tend to focus management on the ecosystems approach and sustainability of watershed as the method and objective of management. Adaptation provides the basis for integration as we learn more about both.

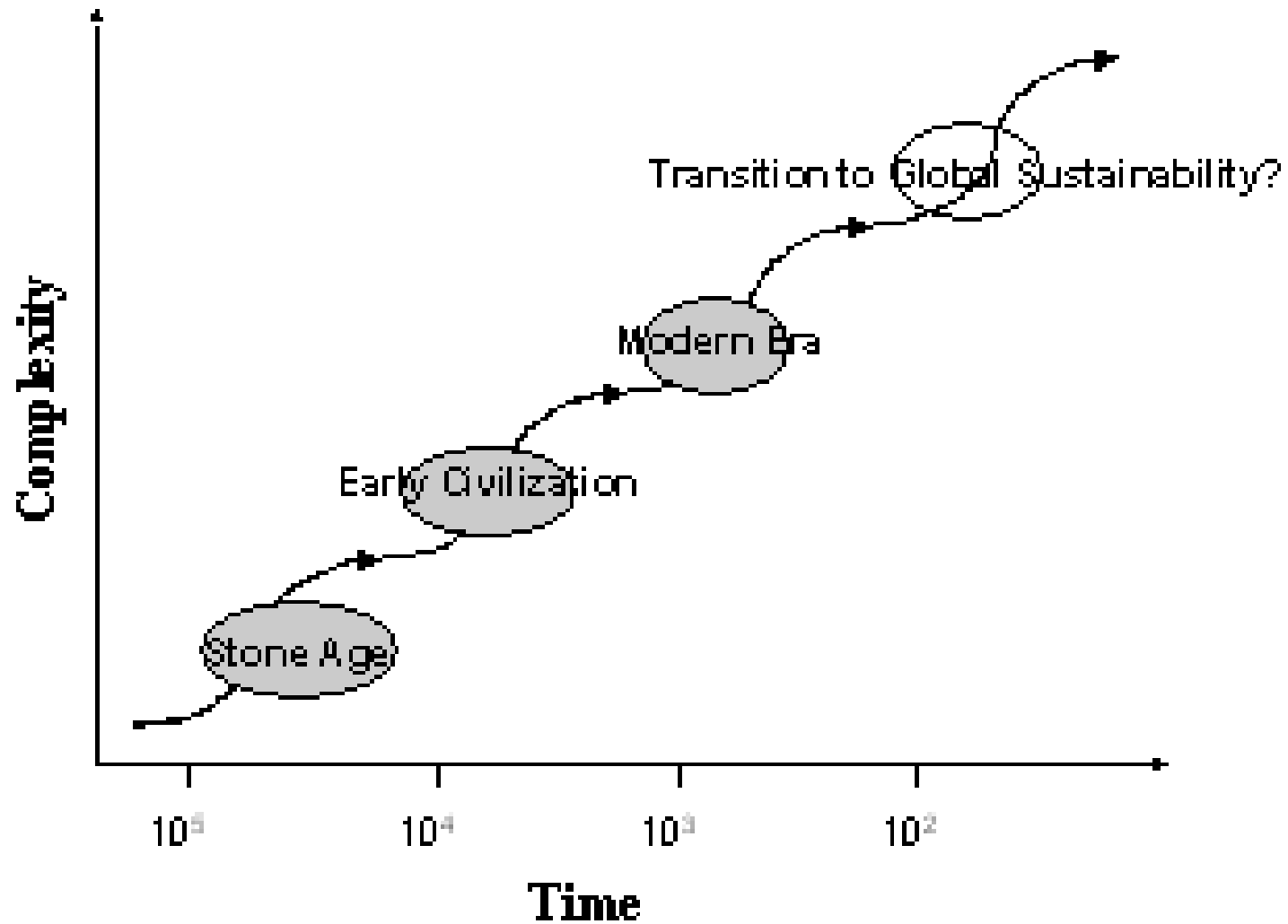
Wicked Problems

- Water for the environment (in-stream flow requirements)
- Water for Human Health
- Non-point source Pollution
- Climate Change
- Species Diversity and Endangered Species
- Economic Growth and Technology
- Population growth
- Spatial and temporal patterns of change

Whither management?

- Today's' watershed problems represent a complex set of often conflicting issues
 - concern for environment
 - concern for economy
 - concern for health
 - rapidly changing institutions and organization
 - concern for the public interest and rights
 - concern for private interest and rights
 - rapidly changing values
 - rapidly changing issues
 - concern for risk and precaution

The Acceleration of Time and Complexity



Uncertainty and Risk

- Uncertainty - is the state of knowledge with respect to the possible occurrence of an event
 - it stems from a number of sources: lack of systems knowledge, lack of observational knowledge and lack of agreement of the many sources of knowledge
 - it can stem from external sources (influences on the system) or from internal sources (errors on the part of the manager)
 - uncertainty is inherent in any complex process
- Risk - is the occurrence of an uncertain event subject to knowable probabilities for a given period of time or space in combination of the harm done should this event occur
 - our understanding of risk emanates from our experience or from observational record
- "Unanticipated surprises, being unanticipated, become crises" (Hollings 1993).

Impacts of Uncertainty and Risk

- Vulnerability – is the degree to which a system is susceptible to or is *exposed* to the effects of an event or sequence of events
 - vulnerability can be due to the nature of the system or a part of it
 - vulnerability can be a function of the event and its nature
- Sensitivity – is the magnitude of the *response* of a system to a disturbance as in the amount of change that occurs in relation to the magnitude of the event

Coping with Uncertainty

- Ignore it.
- Postpone Decisions until you have better information.
- Assume the worst (precaution)
- Assume the Best (naive optimism).
- Learn by Doing (adaptation).

Two Approaches to Uncertainty and Risk in Management

- 1) **Precautionary Approach:** If an activity poses a risk to human health or the environment precautionary measures should be taken even if some cause and effect relationships are not fully established.
- 2) **Adaptive Approach:** If an activity poses a risk to human health or the environment and the harm done will either occur incrementally over an extended period of time or will be reversible then an adaptive management process can be applied to adjust management to the uncertainty over that time or to remediate any harm done.

When is adaptation an issue

- Under some circumstances change means that the watershed will track in a new direction which will not be reversible (irreversibility)
- When there is a one way progression the development in which there is no opportunity for exercising control and re-tracking the experiment (lack of control)
- The adaptive approach is based on learning by anticipating, through a combination of forecasting and adjustment if there is no effective monitoring then it can not be applied
- If the development takes place rapidly compared to the progression of its impacts then there may not be time to learn and adjust

What to do if Adaptation is an Issue

- Consider the scope and severity of harm done e.g. risk tolerance
- Consider using the precautionary approach
- Consider using adjustments to the process to provide the necessary opportunities for adaptation
- Consider using a combination of precaution and adaptation

When Can it be used

- Implementation can be treated as a **purposeful experiment**
- **All parties are committed** to or are required to participate in the experiment
- **All parties accept** that the rules and requirements can change
- The **risk of not experimenting is greater** than that of the experiment
- When **there is a progression of development in time** and there is the opportunity to intervene sequentially as we learn more about the problem and the solutions

When Should it be Used

- *There are no simple cause and effect relationships.*
- *There are no universal stability regimes.*
- *There is no easy way out.*
- *There can be no neat packaging of problems in time and space*
- *The impacts of the experiment can be reversed*

Adaptation In planning and Management

- Adaptive capacity – the ability to adapt
- Adaptation – an intervention that improves the outcome of a process.
- Adaptive design- design solutions that respond to many eventualities
- Adaptive planning- plans that provide for a number of outcomes depending on context
- Adaptive management- management that adjusts to learning and informs planning and design



Adaptive Management of Policy

Policy Cycle

- Typically a product of a complex set of interactions of the elected decision makers, the public service and the publics
- Developed over time and applied through legislation, and regulation, policy statements, budgets, programs and projects
- Implementation often varies from place to place and time to time.
- Policy is infrequently evaluated
- It is often revised
- It is ideal for adaptive management

The Adaptive Policy Cycle

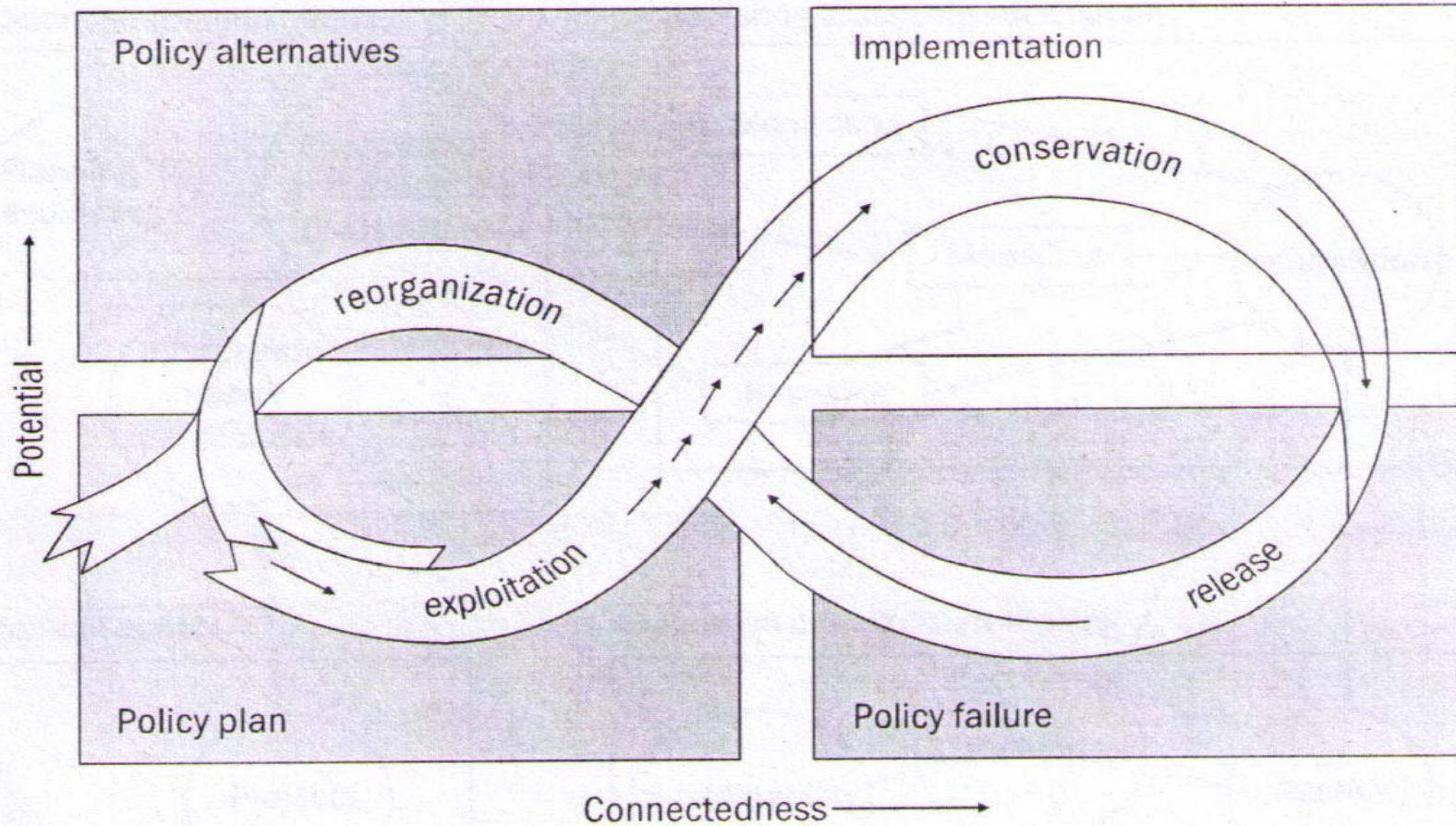
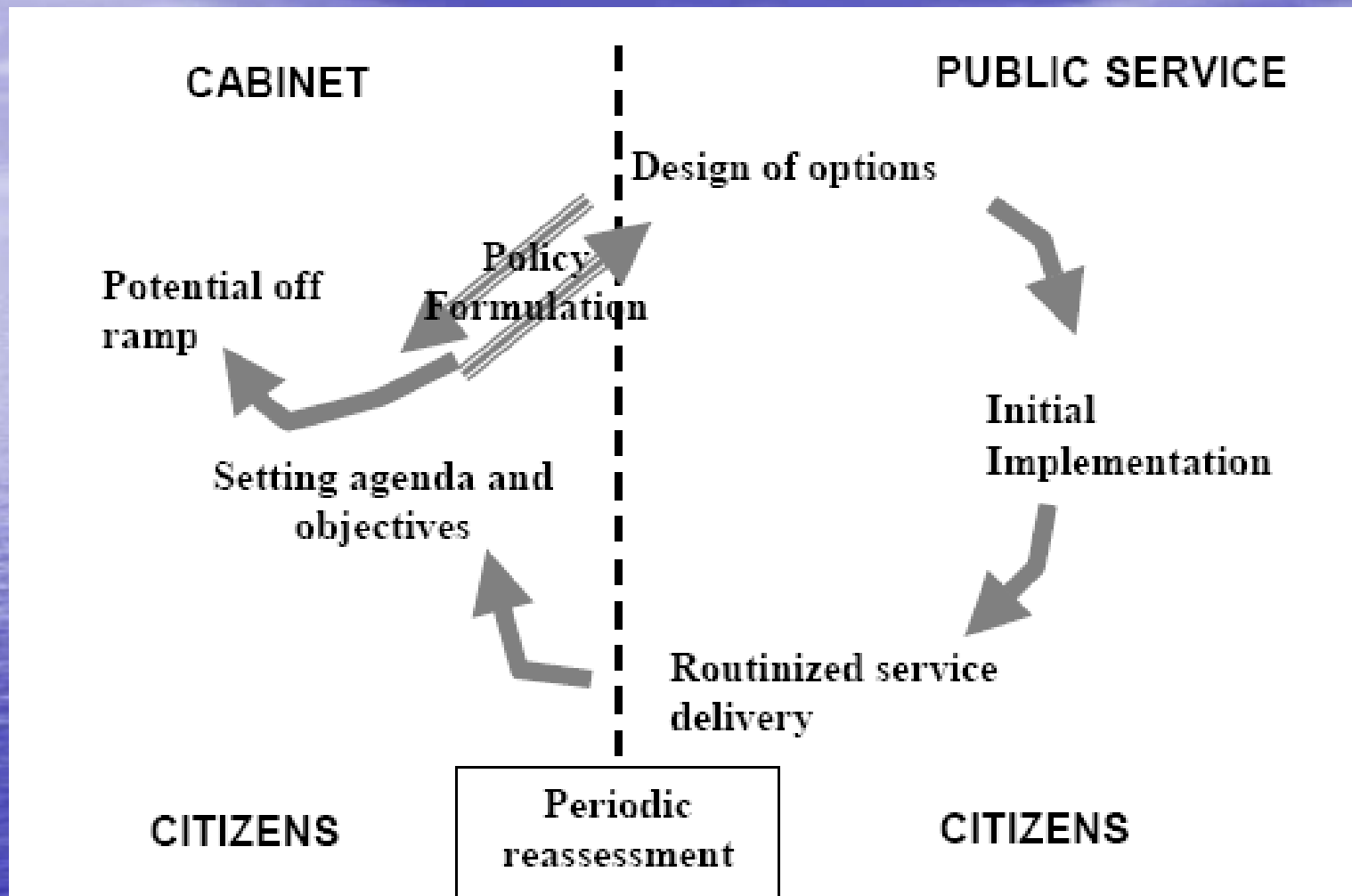


Figure 2.5 The adaptive cycle

Source Gunderson, Holling, and Peterson (2001)



Eight steps

- Issue identification (*adaptation*)
- Policy analysis (*adaptation*)
- Policy instrument development (*adaptation*)
- Consultation (which permeates the entire process)
- Coordination
- Decision
- Implementation (*adaptation*)
- Evaluation (*adaptation*)
- Revision of Policy (*adaptation*)

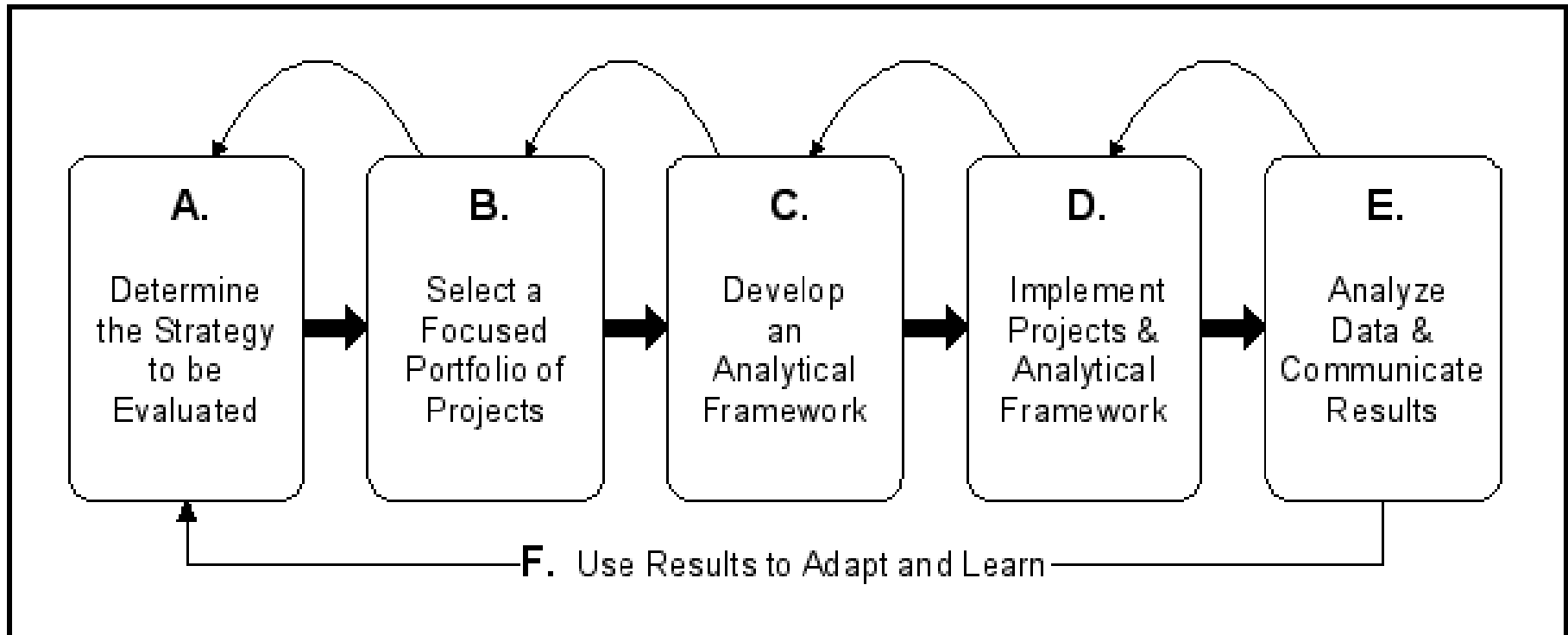
Adaptive Management of Programs

Programs are the most visible
outcome of policies

Need for Adaptive Project Management

- Multiple Objective
- Multiple Agencies
- Multiple Jurisdictions
- Multiple Publics
- Limited and unreliable funding
- Changing priorities

Adaptive Management Steps



Source: Adapted from Salafsky & Margolis, 1999.

Operative Description

- An adaptive management approach is generally understood to be a systematic process for continually improving management practices over time by emphasizing learning through experimentation. Adaptive management also incorporates collaboration among stakeholders, managers, and scientists who are knowledgeable about the system being evaluated. The comprehensive, iterative, and collaborative nature of an adaptive management approach is why it was implemented as part of the long-term management strategy for refining operations.

Glen Canyon Dam Adaptive Management Program
(GCDAMP)

Steps in the Process

- Needs assessment (*adaptation*)
- Alternative Implementation instruments (*adaptation*)
- Instrument selection
- Implementation Plan Development (what, where, when, why, how, by who) (*adaptation*)
- Program proposal and review (*adaptation*)
- Program approval and funding
- Program implementation (*adaptation*)
- Program Evaluation (*adaptation*)



Adaptive Management of Projects

Adaptive Project Management

- Goal/Client-focused
- Goal/Client-driven
- Incremental results early and often
- Continuous question and introspection
- Change is progress to a better solution
- Don't speculate on the future

Adaptation

- Is possible if you have control and time for an experiment, for learning, for revision and improvement
- There are approaches to developing these opportunities:
 - 1) Phasing
 - 2) Conditional approval
 - 3) Negotiated Binding/Regulatory Agreements

Project Development Steps

- Development Proposal
- Project Design
- Impact Assessment
- Approval
- Implementation
- Monitoring
- Completion
- Decommissioning/ redevelopment

Phasing

- Many projects can be implemented in a sequence of phases each of which can operate and be successful individually
- Depending on the successes of a phase procedures for subsequent phases can be revised based on what is learned initially.
- It requires that each phase be monitored and evaluated prior to approval of subsequent phase
- It requires that the processing of monitoring and evaluation be coincident with implementation (multi-streaming)
- It requires that impacts be manifest rapidly so that they may be observed and responded to in short time periods

Conditional Approvals

- Conditional approval offers opportunity for adaptation. It is based on achievement of stated objective and provides for revision of approval should those objectives not be met
- It requires agreed upon monitoring and evaluation
- The adaptation process is usually one of negotiation and can be difficult
- Processes such as conditional approval are utilized in Certificate of operations type instruments

Negotiated Agreements

- A form of co-Regulation that give all parties an opportunity to revise and rethink project management
- Widely used in the EU under the Lisbon Protocol
- Requires support of the regulatory process
- Limits right of appeal while providing for opportunity for flexibility



Adaptive Decision Making

Adaptive Decision Making Considerations

- The Decision Problem
 - Information gaps
 - Need for accuracy
 - Effort required to obtain accuracy
 - Possibility of reassessment in the future
- Internal Social Context
 - Decision makers expertise
 - Analytical resources
 - Accountability
 - Social relationships
 - Communications networks

Decision Making Considerations

- The external Social Context
 - Societal values
 - Societal goals
 - Accountability
 - Group membership of stakeholders
 - Stakeholder relationships
 - Geography
 - Time frame
- Decision Context
 - Routine decision
 - Crisis decision
 - Controversial /divisive decision

After Anderson, Hilborn, Lackey and Ludwig 2003

Questions on Decisions

- **Nature of the Problem**

- Is there a trade off between accuracy and effort or time?
- Is the system easily divided spatially or temporally?
- How can we recognize a satisfactory decision or progress toward a solution?
- How long will it take the system to respond to the proposed management?

- **Internal Social Context**

- Will the problem solving be carried out by an individual or group?
- What kind of scientific analysis will decision makers be able to understand and convey to others?
- What consequences will decision makers experience if they undertake an experiment or innovation?

Questions on Decisions

- External Social Context
 - If there are multiple goals, do their objectives suggest related metrics or are they incommensurable?
 - Is the social context easily divided along geographic lines or along other dimensions? (socio – economic, stakeholder group etc.)
 - Can we expect social conditions and goals to change over time?
 - Are there legal or political time constraints
 - Where does science fit in?
- Decision context
 - If the decision is part of a routine program are the decision makers confident of the process?
 - Do the decision makers have confidence in their advisors?
 - Are the decision makers accountable?
 - What is the relationship among the decision makers?
 - What is the relationship of the decision makers to the stakeholders?

Challenges for Watershed Management

- Governance: The Public interest, public interest groups , participation and collaboration
- Politics and Power
- Science and Ideology
- Economics and Ideology

New Governance, New Management, New Capacities and Skills

- Planning in the face of uncertainty and risk considering vulnerability and sensitivity
- Decision making in the face of uncertainty and risk considering vulnerability and sensitivity
- Implementing in the face of uncertainty and risk considering Vulnerability and sensitivity
- Working in a multi-stakeholder environment in the face of conflict, considering political and economic vulnerability and sensitivity

End Note

BOX 3.1

Valuing the Benefits of Adaptive Management

Many of adaptive management's benefits come in the form of better knowledge of ecosystem response to management actions. This improved knowledge reduces uncertainties and should therefore improve management decisions. Benefits of better future management decisions will be realized in the future. These benefits, however, are difficult to measure and translate into dollars, the standard metric of economic analysis. The intangible nature of these benefits stands in contrast to the direct, up-front costs of adaptive management programs, such as ecosystem monitoring programs, scientific staff, and institutional support. Gaining political approval and funding for adaptive management may be difficult if traditional, standard economic analysis cannot be or is not done. Clear articulation of the benefits of adaptive management to stakeholder groups, decision makers, and budgeters, may thus constitute a challenge to persuading skeptics of the value of the concept. Failing to learn from past experiences may entail costs in the form of inefficient operations and protracted controversies that spring from policies that have not been adjusted to changing conditions and social preferences.