

**Paradigm Shift:
Integrating decision analysis and
stakeholder input for sustainable
environmental decisions
OR:
DQOs....The Next Generation**

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A (VERY) Brief History of Environmental Decision Making

- In the beginning, there was chaos....
- Then came the DQO Process (1986)
 - Great for binary decisions, e.g.:
 - Are site concentrations greater than background?
 - Is the mean site concentration greater than the threshold of interest?

Future of Environmental Decision Making

- Need to provide tools to risk managers for decisions like:
 - Should my lab add a new method to our scope of accreditation?
 - Which remediation method should I implement?
 - Which buildings should we investigate for Vapor Intrusion?

Future of Environmental Decision Making

- Need to provide tools to risk managers for decisions like:
 - Is an accreditation or certification program better for situation Z?
 - How should we divvy up work across contracts?
 - Should we use in-situ or laboratory analyses?

Making Decisions

- We don't always put a lot of thought into the decisions we make...

Quick Decisions



Quick Decisions



Quick Decisions



Unsupported Decisions



Data
Information
Science

Optimal
Decision

Cognizant Decisions



Cognizant Decisions



Cognizant Decisions



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Notice

**Record of Decision for the Final Supplemental Environmental Impact Statement for
Guam and Commonwealth of the Northern Mariana Islands Military Relocation**

Cognizant Decision Making



What is Structured Decision Making (SDM)?

- A framework for “formalized common sense”
- SDM helps solve complex problems in an *optimal, reproducible, technically defensible, transparent, and adaptive* manner.
- The role of SDM facilitation is to help individuals and groups solve their own problems - it is not to solve their problems for them.

Let Me Repeat That...

SDM helps solve complex problems in an *optimal, reproducible, technically defensible, transparent, and adaptive* manner

Paradigm Shift ...

1. Collect data

1. Statistics and analysis

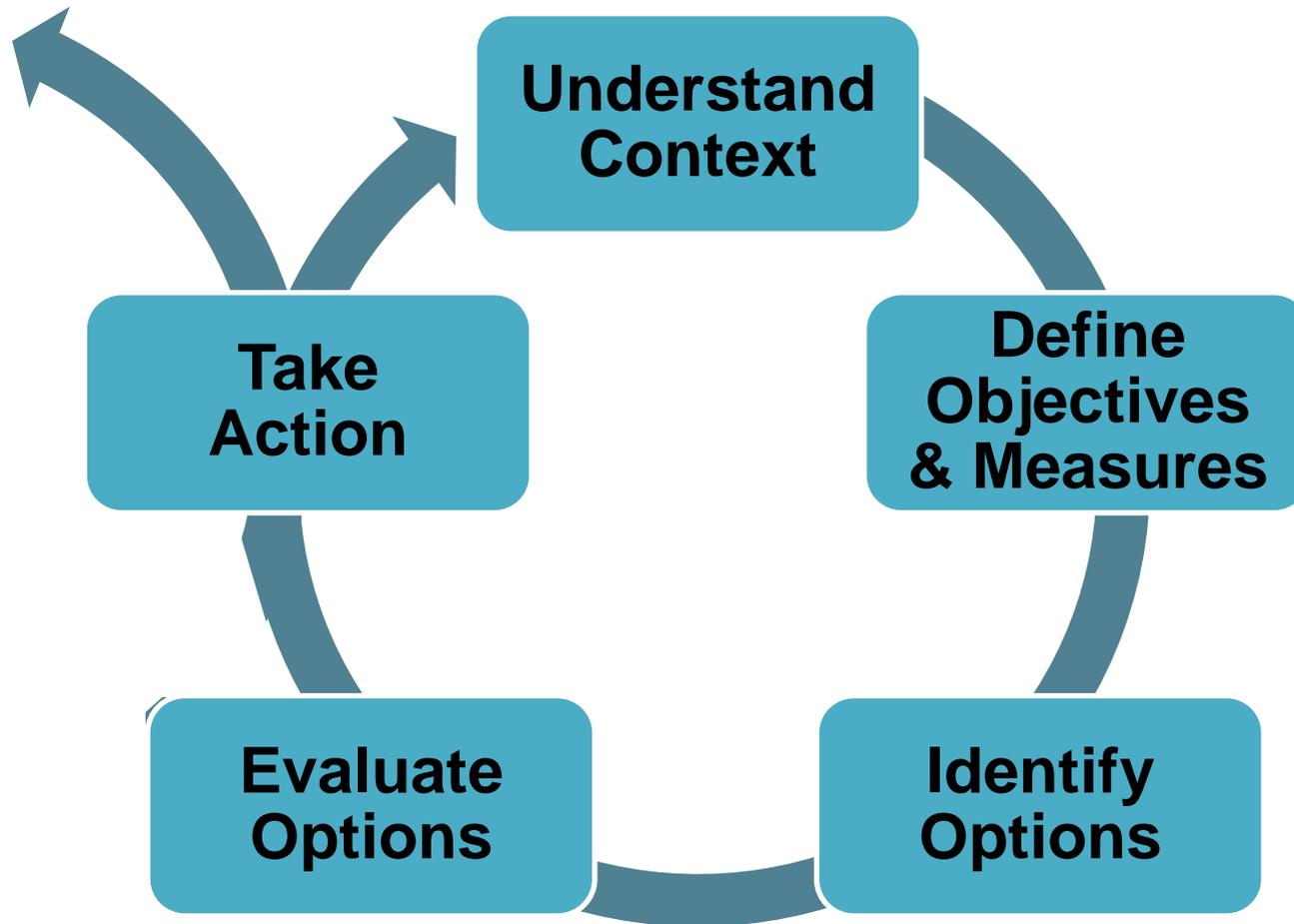
2. Risk assessment

3. Stakeholder engagement/communication

Paradigm Shift

1. Stakeholder engagement/communication
2. Decision analysis
3. Risk assessment
4. Collect data

Structured Decision Making



1. Understand Context

- Describe the problem
 - Decision Landscape
 - Social Network
 - Regulations
 - Map
 - Cost constraints
 - Timetable

2. Define Objectives

- Value-Focused Thinking approach
- Involve appropriate stakeholders
- Elicit objectives
 - Measurable attributes
 - Value of one attribute over another



3. Identify Options

- What sorts of things can be done?
- What “switches” can we adjust? E.g.:
 - Order of operations
 - Remediation alternatives
 - Analysis methods
- Both single and groups of options should be considered.

4. Evaluate Options

Here's where traditional science comes in...

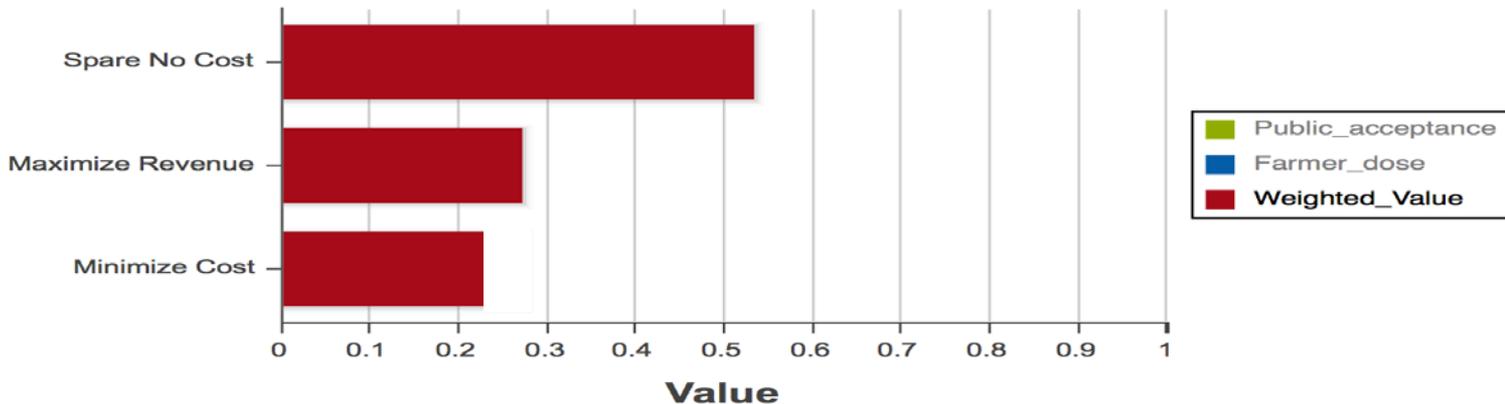
- Measurements / data / information
- Numerical models
 - Environmental, financial, social
- Model evaluation / results
 - Uncertainty analysis
 - Sensitivity analysis
 - Value of Information analysis

5. Take Action

- Implement optimal alternative(s)

Scenario Comparison

The chart below shows the mean Scenario [Value](#) for each [Measure](#) and [Index](#). The *Scenario_Comparison* Index is a weighted average of the all the Measures [Value](#), weighted by the [Objective weights](#). The Dredge Scenario is the highest valued Scenario based on the *Scenario_Comparison* Value.



- Adaptive management
 - Monitor and evaluate effectiveness over time
 - Triggers for revisiting decision

Examples of Implementation

- EPA: Coral Reef protection in Guanica Bay, Puerto Rico
 - Dredge reservoir or implement shade-grown coffee?
- DOE: Disposal of nuclear waste
 - Leave in place, or move...to which disposal facility?
- FDA: Prioritize food shipments to inspect.
- Florida: Assist towns with resiliency planning in preparation for impending sea level rise.
- DoD: ???

Structured Decision Making



SDM builds a bridge to Optimal,
Defensible, Transparent Decision Making



Structured Decision Making with GiSdT (Guided Interactive Statistical Decision Tools)

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