

Overview

Structured decision making (SDM) is an organized approach for helping people work together to make informed and transparent choices in complex decision situations. A learning-centred approach, it's particularly useful in decisions where there are multiple and competing interests, difficult value-based trade-offs and uncertainty. SDM helps build shared understanding by clarifying relevant values and objectives, collaboratively exploring a range of management alternatives and their consequences, and promoting respectful deliberation about trade-offs and uncertainties.

Rooted in best practices from the decision sciences, and informed by deliberative traditions from many cultures, SDM provides practical tools to realize calls for greater inclusivity, deliberation, transparency, and accountability in decision making about interconnected social and ecological systems.

A key feature of SDM is its emphasis on careful treatment of both facts and values in decision making. As a result, SDM enables decision-making that is informed and evidence-based (informed by western sciences and Indigenous knowledges), as well as transparent and value-based (based on explicit judgments about "what matters" to people). The collaborative process promotes dialogue and constructive debate and helps people focus on interests rather than positions.

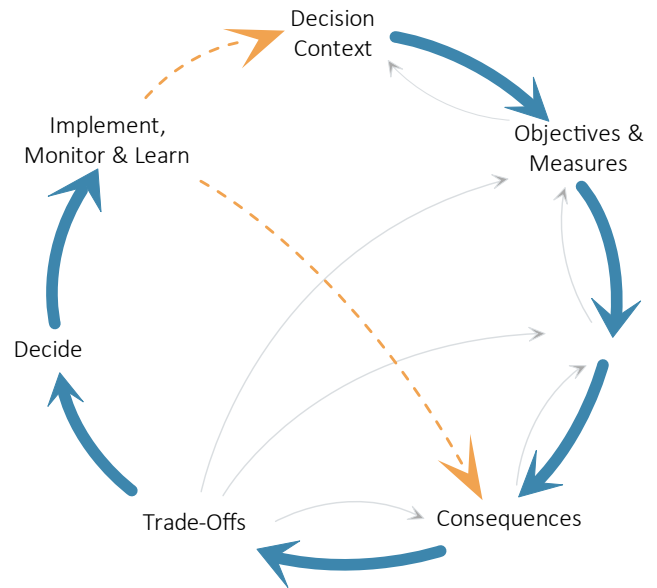
A good decision process is iterative (the grey arrows in the figure), with learning at later steps often causing refinement to earlier work. On complex decisions, participants may work through several rounds of evaluation before agreement is reached. What exactly is done at each step, to what level of rigour and complexity, will depend on the nature of the decision, the stakes and the resources and timeline available.

A key point is that structured methods don't have to be time consuming; even very basic structuring tools and methods can help to clarify thinking, minimize errors and biases, and ensure that the technical and values basis for difficult decisions is transparent and defensible.

When SDM is used to make recurring decisions over time (orange arrows), it's often called Adaptive Management. This integration of SDM and Adaptive Management has become widely recognized as a practical and responsible way forward when decision making is complicated by persistent uncertainty.

➤ Clarify the Context

The first step is to clarify the decision context. What is the underlying problem or opportunity? What is the decision to be made and who will make it? What's in and out of scope and what does that tell us about what values are at stake and what range of alternatives will be considered? Key constraints for the process (timelines, budget, legal issues) are also identified.



This step has three main tasks: framing the decision, sketching the decision, and designing the decision process. Often overlooked, this step is both harder than it looks, and critical to good decision making.

There are usually several different ways the decision could be framed. The challenge is making sure it's framed in a way that addresses the underlying problems, recognizes institutional complexities, and challenges assumptions while accepting hard constraints. *Decision sketching* involves quickly running through the SDM steps at a scoping level. It helps clarify the focus and frame of the decision and confirm that everyone involved has a common understanding. Sketching provides important insights into what information is going to be required, who is going to be affected and therefore needs to be engaged, and who the ultimate decision maker(s) will be and what their needs are.

Following a decision sketch, the process can be designed, including a detailed work plan and budget to guide the necessary analytical and engagement work.

Interestingly, a sketch often reveals that there is a better way to frame the decision. With a few hours or days spent on sketching, a group can avoid months of effort working on the wrong decision.

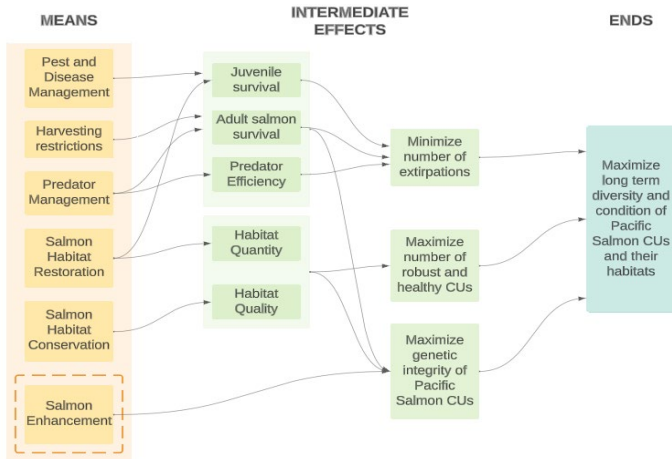
➤ Identify Objectives and Measures

At the core of an SDM process is a set of well-defined objectives that clarify "what matters" – the things that people care about and could be affected by the decision. Objectives should include all the things that matter, not just the ones that are easily quantified (e.g., increase the abundance of salmon, minimize greenhouse gas emissions, increase cultural value, etc.).

Measures (also called attributes, performance measures or evaluation criteria) are the specific metrics that will be used to

estimate/model and report the consequences or performance of the alternatives on the objectives.

Structuring tools such as *influence diagrams* or *effect pathways* that link actions at one end to outcomes at the other, are useful in identifying fundamental values, separating means and ends, building shared models of cause and effect, and selecting appropriate measures.



Influence diagrams, or pathways of effect, clarify means and ends, and build shared understanding about mental models of cause and effect. This one shows the effects of a range of management options on Pacific salmon.

The outcomes from this step is a common set of objectives and measures that everyone agrees will be used to evaluate the alternatives. It is neither necessary nor useful to weight them at this stage.

Together, objectives and measures drive the search for creative alternatives and become the framework for comparing alternatives. They help a group to prioritize and streamline information needs, such as data gathering, modeling and expert processes and are focused on producing decision-relevant information. They become the focus of value-based deliberations about key trade-offs and uncertainties. Taking time to get them right is a critical step worth investing in. Ultimately, they simplify choices, especially group choices, because large numbers of complex options can be consistently and efficiently evaluated by multiple decision makers.

Develop Alternatives

Alternatives are the various actions or strategies that are under consideration. Creating and evaluating a range of well-defined, internally coherent alternatives is central to good decision making. In public planning processes, having stakeholders participate in the process of alternatives creation is important both for ensuring that a wide range of possible solutions to the problem are heard and explored, and for supporting participant buy-in of the process.

In some contexts, alternatives are easy to identify (e.g., alternative vehicles that could be bought, alternative community projects to fund, etc.) and the work is in evaluating them. In many environmental management contexts however,

the alternatives are complex sets of actions that need to be thoughtfully developed (e.g., alternative ways of managing a park, recovering a species, sharing water, or sequencing development). This step therefore involves iteratively developing, comparing, and refining alternatives in the search for one(s) that offers the best balance across objectives. Often there are several rounds of identifying and evaluating alternatives as more is learned (through modeling and other methods of consequence assessment) about how well different combinations of actions work.

A *value-focused thinking* approach involves using the objectives to generate and evaluate a broad range of creative alternatives. Initially, the focus is on identifying exploratory alternatives that promote collective learning, often beginning with ‘bookends’ that represent very different approaches. These are then iteratively refined. In most environmental management contexts, it is important to search for alternatives that are robust to key uncertainties or that are likely to reduce them over time. *Strategy tables* can help when the number and diversity of individual actions under consideration are overwhelming and need to be grouped into logical packages.

Population Management	Habitat Protection	Restoration
Maternal Penning	High Elevation Habitat	None
Supplemental Feeding	Low Elevation Habitat	25%
Primary Prey Management	Matrix – Corridors	50%
Predator Management	Matrix – Full Protection	75%

A strategy is a logical combination of actions that make sense together. In this example, there are three categories of management actions (top row). Green cells identify actions included in this strategy.

Estimate Consequences

At this step, best available evidence and critical thinking are used to describe the predicted consequences of the alternatives. An important principle in SDM for ensuring decision quality and for managing project timelines and budgets is a commitment to decision-focused information. Accordingly, information gathered should be directly relevant to the estimation or understanding of the consequences for the stated objectives and measures. For some objectives, characterizing consequences may involve using complex hydrological, ecological, or socio-economic modeling; for others, it may involve eliciting expert judgment to estimate consequence values, assign relative scores or provide narrative descriptions. Depending on the context, experts may come from diverse domains and systems of knowledge, including Indigenous and local knowledge, as well as science, economics, or engineering. Care is taken to respect the integrity of different knowledge systems, with important insights usually drawn from each.

Results are typically presented in a *consequence table*, which summarizes the expected performance of each alternative with respect to each decision objective, as reported by the performance measures. If there are uncertainties that affect the selection of a preferred alternative, these should be reflected in the consequence table so that decision makers can make choices that reflect their risk tolerance. The process of populating a consequence table involves important shared learning about what is known and not known about potential outcomes. It highlights and focuses deliberations on key value-based trade-offs.

Objective	Less Preferred	More Preferred	Performance Measure	Bouldin Island	Bacon Island	Webb Tract
Subsidence			Land vol lost (M Cubic feet)	475	541	88.7
GHG Emissions			CO2-e (M Metric tonnes)	3.2	2.1	1.3
Water Supply			Reliability Risk Score (1-10)	2	3	5
Ecological Habitats			Opportunity score (1-10)	6	5.5	9.6
Ecocultural Restoration			Opportunity (1-10)	7	4.8	5.5
Recreation			Opportunity Score (1-10)	7	4.5	5.9
Project Economics			Net Revenue M \$US	2.6	3.4	1.8

Colour-coded consequence tables are helpful in highlighting and focusing dialogue on key trade-offs across alternatives. Here, dark blue indicates better performance, while light blue indicates poorer performance.

Evaluate Trade-offs and Preferences

At this stage, the goal is to find the alternative that offers the best balance across the objectives, in consideration of the diverse values and perspectives of the affected parties. This step involves thinking and talking about difficult value-based trade-offs, clarifying preferences and the reasons for those preferences, and seeking a solution that can be broadly supported.

Trade-offs among competing objectives are at the core of most difficult decisions and, in contrast to other approaches, SDM addresses them directly. A variety of methods from the decision sciences can be used to facilitate constructive deliberations about trade-offs and to ensure that value-based trade-off judgments are informed, consistent and transparent. Simple decision support tools (e.g., *pair wise comparisons*, *dominance* and *sensitivity assessments*, etc.) are commonly used. Poor performers are eliminated from further consideration, and desirable elements from different alternatives are combined to create new ones. The process is typically iterative. Sometimes a new alternative is identified, triggering another round of evaluation. In other cases, making trade-offs is complicated by uncertainty, and it may be appropriate to go back and refine the data and analysis used to estimate consequences.

Often, a deliberative approach is sufficient to lead to informed choices. A good deliberative trade-off process emphasizes respectful reason-giving, reflection, and learning. Structuring tools and professional facilitation can help to promote co-learning, build a broader appreciation of the perspectives of others, expose errors of logic and reasoning, and improve the consistency and transparency of choices. In this approach,

participants think and talk about what matters (as defined by the objectives and measures), about which outcomes are more or less important, and about which set of trade-offs is more or less acceptable. Because the process separates technical judgments (about consequences) from value judgments (about objectives and trade-offs), it's easier for groups to have frank and respectful conversations even when they disagree, to diagnose *why* they disagree, and to build a shared understanding and respect for different perspectives on trade-offs and uncertainties.

If there are challenges in reaching a widely supported alternative, it may be useful to use more structured preference assessment methods for explicitly weighting the measures and deriving scores and ranks for the alternatives. These methods can be used to focus deliberations on productive areas and maintain an interest-based dialogue, rather than a positional one. The emphasis with all such methods is on group learning and collaborative exploration of trade-offs, with the goal of finding an alternative that achieves a balance across multiple objectives and is acceptable to a broad range of people. It is *not* to apply a formula to prescribe a solution.

Decide

Once participants in the SDM process have explored a reasonable range of alternatives and deliberated about key trade-offs and uncertainties, they should have the information they need to make an informed choice.

What happens next, including the role and importance of consensus, varies depending on the decision context. Many SDM processes are advisory in nature. Usually, these processes seek but do not require consensus. While consensus is generally desired, pushing too hard for it is increasingly seen to be counterproductive; it can silence minority voices, and detract from creative solution-finding. Decision makers will get important insights from an SDM process regardless of whether it produces a consensus. In these advisory processes, decision makers are briefed on the SDM process, and the views of the different parties involved, and then they deliberate about the irreducible trade-offs and uncertainties and make final decisions.

In some cases, SDM processes occur in a shared decision making context (e.g., between multiple agencies or governments, including Indigenous governments, local governments, provincial/state, and federal bodies). That is, the people at the SDM table have the authority and the responsibility to make a final decision together. In these cases, the role of consensus is critical as it forms the basis of a group's final recommendation or decision. Regardless of who makes the decision or how, the structure and clarity of an SDM process provide a basis for transparently documenting the decision process, outcomes, and reasons. Documentation should include all the alternatives that were considered along the way and the reasons why they were rejected or modified, as well as the final areas of agreement and disagreement and associated reasons. Importantly, the value-based rationale for the decision is explicitly communicated along

with the supporting evidence. This goes a long way to addressing calls for greater transparency and accountability in public decision making.

➤ Implement, Monitor and Review

At this final stage, the SDM process focuses on what learning is needed to improve future decision making. Effective implementation involves many sector-specific technical, logistical, communication and engagement considerations that are beyond the scope of SDM as a field of practice. That said, implementing in a way that promotes learning is central to improving decisions over time, and thus monitoring and learning, and revisiting decisions based on what is learned, are core parts of SDM practice.

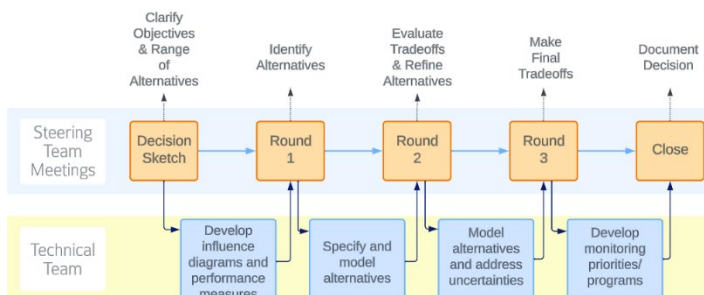
Key reasons for conducting monitoring are:

- Confirming that decisions are implemented in accordance with commitments made during an SDM process,
- Assessing the current state of the system to determine which action to take (e.g., if different actions are taken in dry years vs. wet years),
- Evaluating the effectiveness of management actions,
- Comparing outcomes to predictions (made in Step 4) to learn about the system and inform future decisions.

Many SDM processes result in recommendations for appropriate governance and oversight of monitoring programs and include triggers and mechanisms for review and amendments. Where uncertainty about outcomes affects the selection of a preferred action, commitment to structured learning over time and a formal review of the decision when new information is available can be the key to reaching agreement on a way forward. An initial SDM process can thus transition to a formal adaptive management process. To ensure the relevance to future choices any monitoring programs will be closely linked to the objectives and performance measures used to evaluate management alternatives.

➤ What does this look like in practice?

Throughout the SDM process, meetings do not perfectly mirror the above steps. Rather, the work happens iteratively through rounds of evaluation that are increasingly refined (see figure). Typically, a core deliberative group of 15-20 people is formed to work through the process. They begin with a rough sketch to clarify and build a common understanding of the decision frame. This is followed by several rounds of iteratively identifying and evaluating alternatives. Technical analyses are conducted not as



standalone studies, but in direct response to the needs of the deliberative group and are integrated to serve the next round of deliberations. Input from the broader public is typically sought at key milestones, including confirming the range of decision objectives, and gathering perspectives on core trade-offs presented by refined alternatives.

➤ The Benefits

SDM doesn't make tough choices easy. But it does make them more explicit, better informed, more transparent and more efficient. It does this by:

- Structuring the process – clear steps (a road map) and well defined roles for stakeholders, decision makers and technical experts help keep the decision process on track;
- Directly addressing what matters – even when what matters is hard to value using conventional economic methods;
- Linking analysis and engagement – by creating linkages among decision making tasks it makes the decision process more efficient and improves the relevance of technical and stakeholder inputs to decision making;
- Providing a sound technical basis for decisions – SDM is based on rigorous evaluation of the consequences of proposed alternatives and emphasizes the development of a strong decision-relevant information base that draws on a range of knowledge systems;
- Providing an explicit values-basis for decisions – decisions are not value-free. SDM ensures that value judgments are made thoughtfully and transparently, rather than hidden or buried;
- Exposing trade-offs – trade-offs among competing objectives are at the core of difficult decisions and, again in contrast to other approaches, SDM addresses them directly;
- Exploring creative solutions – by emphasizing the search for joint gains and exposing the nature and magnitude of residual effects, the quality of the solutions is improved;
- Clarifying risk – SDM helps people deal clearly and consistently with uncertainty, explore risk tolerance, make judgments about acceptable levels of risk and precaution, and find creative ways to manage residual risk;
- Leveling the playing field – by distilling complex technical analyses into a small number of well understood performance measures, and carefully separating value judgments and technical judgments, anyone with a stake in the decision can participate at an appropriate level, whether they have technical expertise or not.

Interested in learning more? Visit www.compassrm.com and www.StructuredDecisionMaking.org, and look for our book [Structured Decision Making: A Practical Guide to Environmental Management Choices](#)