

Adaptive Decision Making

Safe adaptation under conditions of time pressure, uncertainty, and stress.

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Avalanche forecasting takes place in dynamic conditions characterized by complexity, goal conflicts, time pressure, resource constraints, and often interactions across boundaries.

To get the job done safely and productively, forecasters must be able to adapt in real time to changing conditions, demands, or resources¹.

This poster describes real time adaptive decision-making, the skills needed, and techniques for developing capabilities for resilient performance.



High-hazard work requires extensive coordination across different roles. Safe real-time adaptation relies on being able to anticipate how changes to one part of the workflow may impact others and to work effectively together under time pressure and stress to revise the plans.

Adaptive Decision- Making

Expertise is a high level of special skill, knowledge, or professional proficiency gained through long practice, study, or training. In a wide variety of domains where conditions change rapidly, expertise itself is insufficient. Instead, a growing body of research has shown experts require flexibility to adapt their usual practice to novel or unstructured problems encountered. In other words, when they find themselves in situations there are no rules or procedures for.

Adaptive decision makers are resilient. They:

 Recognize early signs of a problem²	are sensitive to variation & can spot subtle changes that have negative impacts on their goals; They can anticipate how they may need to change their goals or plan.	For example, a guide notices a client struggling to keep up in the first hour of an all-day tour and knows they will not be able to complete the planned traverse.
 Revise their mental models³	understand their perception or knowledge may be wrong; They know surprises or unexpected results represent a need to question their assumptions about what is happening.	For example, a spatroller ski cuts a slope and gets a much bigger result than expected and realizes they underestimated the presence of a persistent weak layer
 Replan goals & priorities in real time⁴	can modify a known approach or flexibly apply knowledge in new ways to unique situation while maintaining as many goals as possible.	For example, a forecaster at a mining operation knows the heavy precipitation forecasted for later in the week might require an extended road closure, so they inform the ops manager who has crews work longer shifts in the preceding days to minimize downtime to the operation.
 Reconfigure available resources to new plans⁵	know how to reorganize people, equipment, or budget to adjust to changing conditions	
 Review decisions, actions, & teaming to learn from experiences⁶	know they learning comes as much from success as from failure; They make the time to participate in both short-cycle debriefing and thorough investigations to identify recurring patterns	For example, a department of transportation forecaster organizes a learning review meeting with law enforcement, plow truck drivers & equipment operators, supervisors, and the public communications team after a highly stressful road closure event.

Strategies for developing adaptive decision-making capacity

1. Create opportunities to gain experience with system variability to aid early detection.

- Practice the “hard stuff” and edge cases by using high fidelity training & simulation that challenges problem detection skills
- Encourage experienced forecasters to identify and share subtle signals of issues as they arise

2. Make decompensation (of all forms) visible and give language to call it out

- Enhance monitoring to aid in recognizing anomalous behavior in the weather or snowpack.
- Normalize saying “I don’t know what’s happening right now” to signal uncertainty.

3. Find opportunities to make mental models more visible.

- Encourage verbal ‘walkthroughs’ of one’s logic, assumptions, or considerations in decision making.
- Encourage discussion of all decision criteria including goal conflicts, shifting priorities, ambiguities, and constraints in decision-making.

4. Balance ‘heads down’ with ‘heads up’ time.

- Encourage cross-pollination. Having the maintenance staff shadow the avalanche technician teams can generate new ideas about how to better support early morning control work. Better understanding of each others’ roles, goals, and constraints helps with coordination across organizational boundaries.
- What may appear to be “non-productive” story-telling can help strengthen informal networks and build relationships to enhance future knowledge-sharing and collaboration.

5. Be experimental on your way to scaling adaptive behaviors.

- Engage front-line workers in identifying opportunities for changes that support adaptation and run pilots to stress test the experiments and learn.
- Draw on implementation science, not just change management, when scaling new practices.

Literature

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