A Quick Decision Analysis Process for Selected Environmental Management Decisions

DAAG 2004
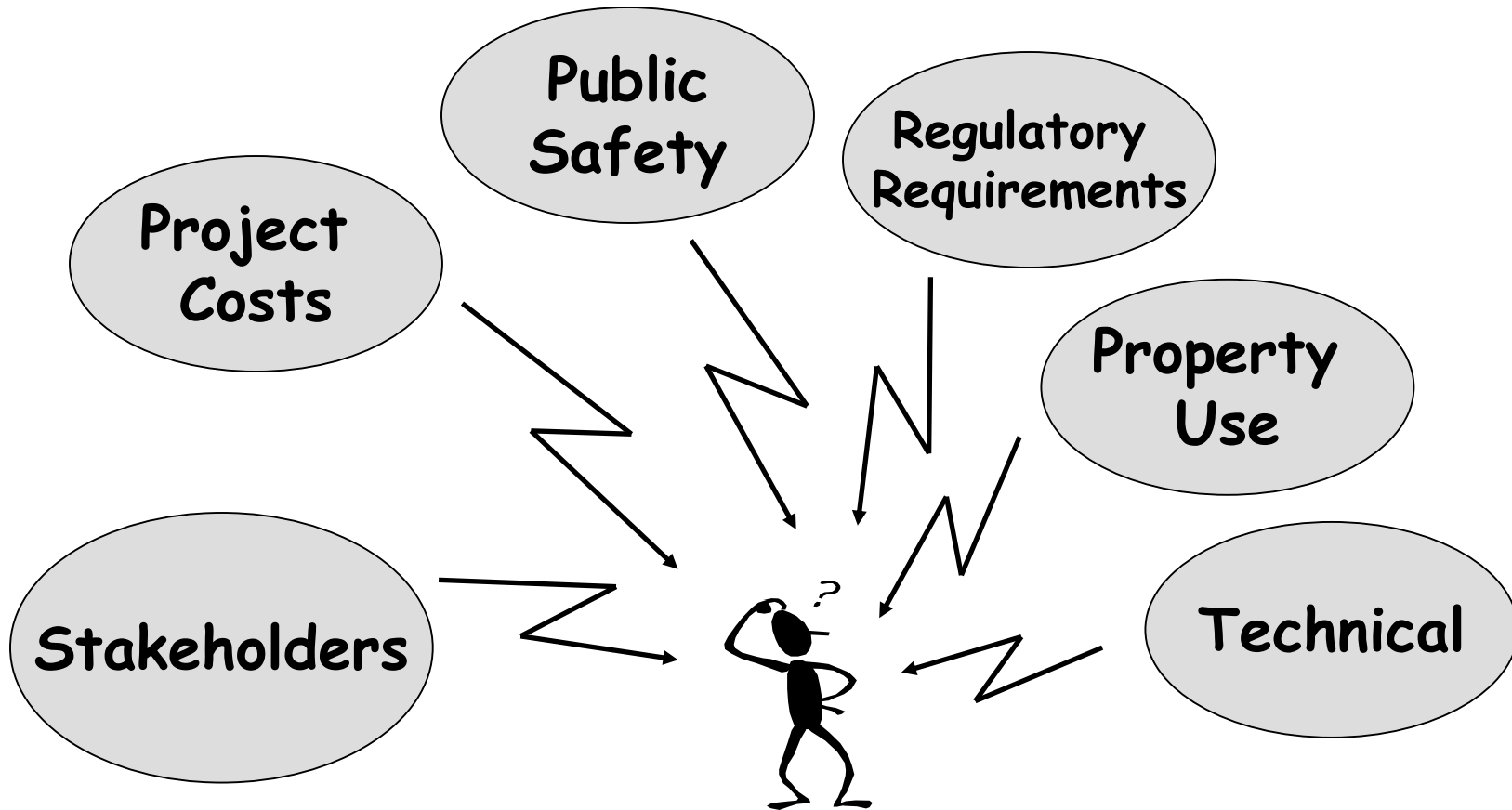
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Outline

- Issues we address
- Criteria for our quick DA process development
- How the quick DA process works

Small $ environmental management sites may have many issues to be managed

Typical project issues and uncertainties

- What are current and future responsibilities? Are they being minimized? At what cost?

- How much uncertainty is there? How can we identify unexpected elements?

- How can we align our objectives with other stakeholders and decision makers? Are there other responsible parties?

- How can we manage our projects more effectively and efficiently?

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Key questions

What is the end state vision for the site?

What are the alternatives/trade-offs?

What is the most cost effective alternative that meets our corporate environmental standards and the minimum legal requirements ?

Do we need more information to make the best decision for the situation?

What contingency plans do we need?

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We wanted a DA process that would

Ensure that corporate environmental objectives are met

Deliver a good decision (e.g. the most effective alternative to meet environmental objectives)

Minimize time to reach a good decision

Minimize the cost of reaching a good decision

Minimize meeting time

Minimize consultant time

Successful and Timely Implementation

Minimize staff time
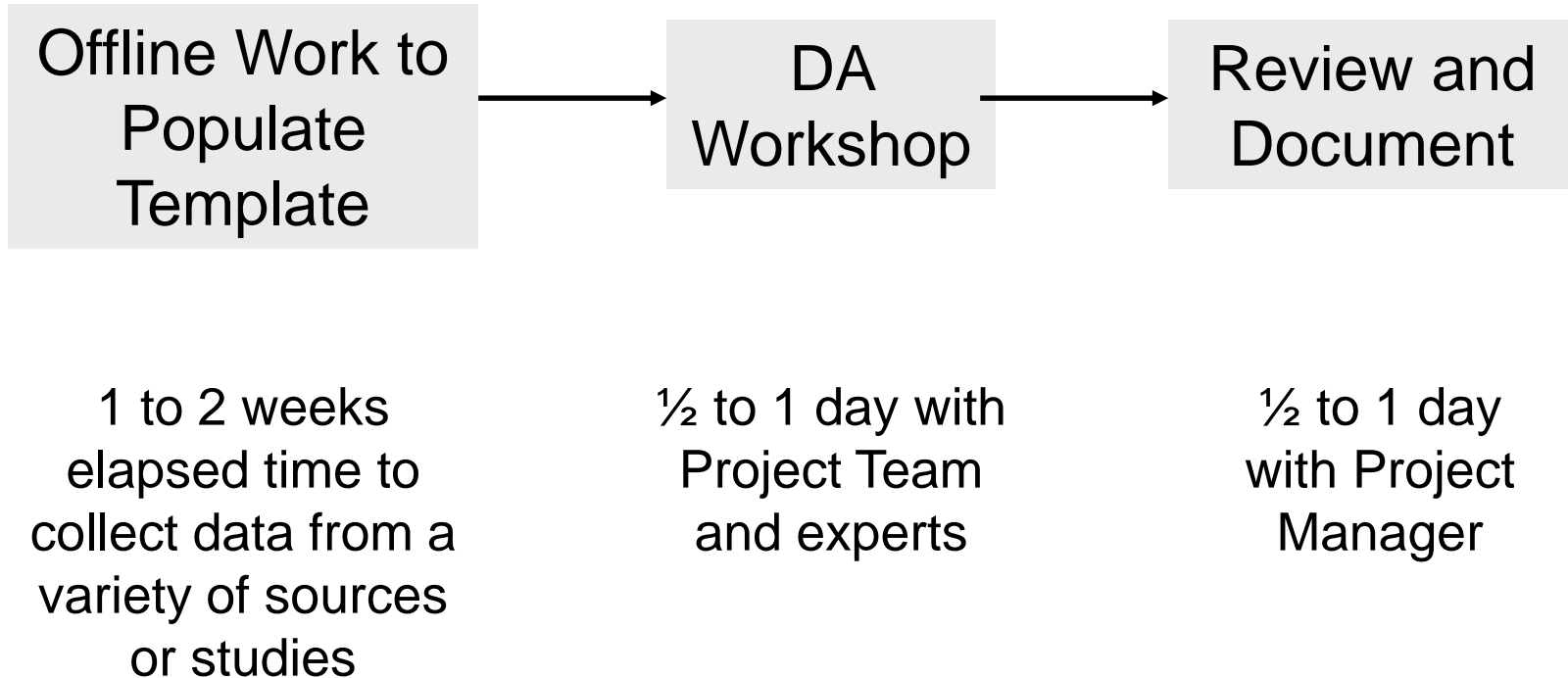
DA process development was guided by

•**Policies**

•Consistent DA process for complex decisions

•Integrate DA results with environmental project management process

•**Criteria**

•User friendly

•Customizable and flexible

•Facilitate input from multiple stakeholders

•All data in one place

•Transparent inputs and outputs – not a black box

•Easy to output key elements to PowerPoint for presentations

•Use standard, approved packaged software (EXCEL, TreeAge™, Crystal Ball®)

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Quick DA process flow and timeline

Offline Work to Populate Template	→	DA Workshop	→	Review and Document
1 to 2 weeks elapsed time to collect data from a variety of sources or studies		½ to 1 day with Project Team and experts		½ to 1 day with Project Manager

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Three major process steps

1. Pre-workshop workbook population with background information, preliminary option selection, and cost range assessments

2. Workshop with stakeholders to
    - confirm drivers and objectives
    - review inputs and options
    - calibrate assessments
    - review cost outputs
    - build decision trees for risk, contingency, and negotiation evaluation
    - ***use real time results to review/revise alternatives***

3. Final documentation and review

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EXCEL Workbook Solution

- **Workbook features**

- Worksheets to capture data for each step of decision process

- Standardized business case model with discounted cash flow

- Input form, ranged inputs, standardized probability distributions

- Real time charting from Crystal Ball® output with overlay views

- Summary metrics and outputs for use in decision trees

- Macro assists for commonly used functions

- Output areas and graphics sized for PowerPoint

The outputs are generated in real time

Evalaution - Example

Enter Data for this Alternative

Site	**Example**
Zone	
Name	**Template**

Date	**15-Sep-02**
Discount Rate	**5%**
Project Start	**2003**

PV Median Results (Full or Allocated)

Allocated Cost ▼

Remedial Lifecycle	$1,615	$000
Legal and Business	$1,478	$000
Total Direct Lifecycle	$3,093	$000
Brand Impact	$86	$000
Future Liability	$20	$000

Set the discount rate to 0 to see undiscounted values

Cumulative Probability PV Total Cost

Probability (%) — 100, 90, 80, 70, 60, 50, 40, 30, 20, 10

$0, $1,000, $2,000, $3,000, $4,000, $5,000, $6,000, $7,000

$ Thousands

View Uncertainty Charts

View Tornado Chart

Pre-programmed template and built-in probabilistic analysis tools
- allow real time review and recycle during workshop
- minimize the time spent in meetings
- maximize productivity of managers and technical staff

Standardized inputs and probability distributions simplify the analysis model but still provide comprehensive sensitivity capability

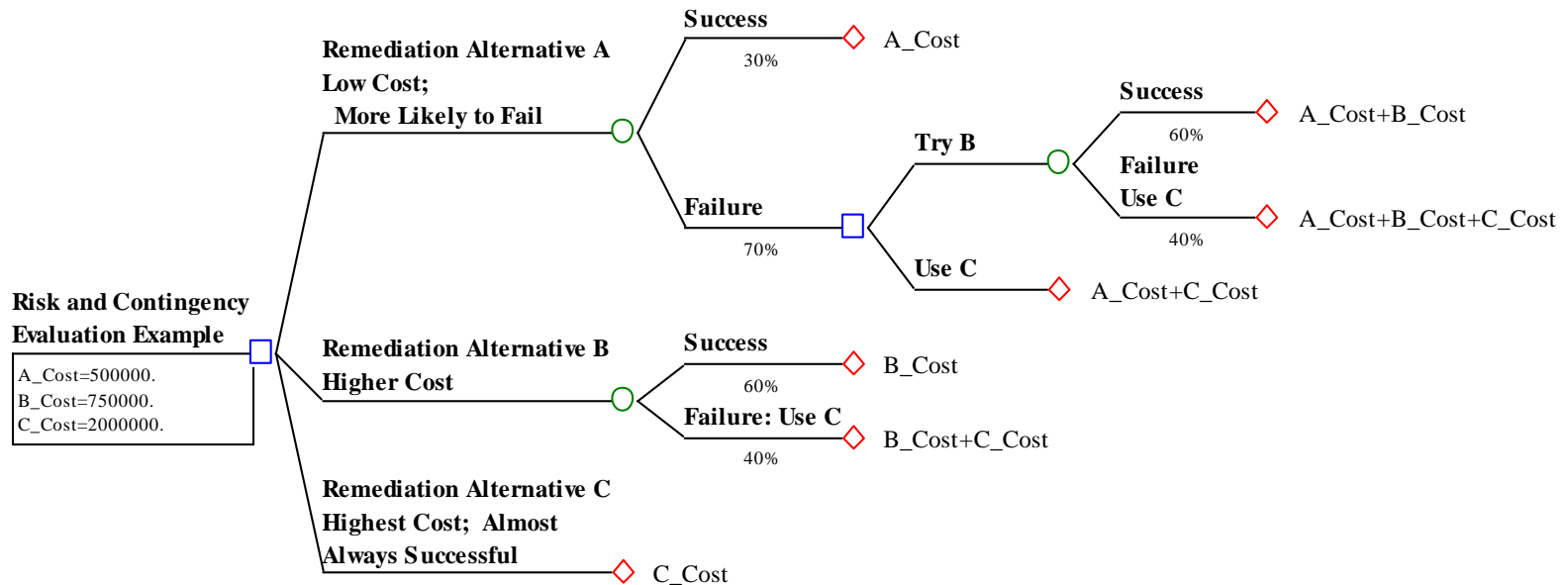|				
Remediation	Excavate	$100	$500	$900
	Barrier	$200	$500	$800
	Cost 3	$45	$56	$78
	Unit Cost	$56	$60	$90
x	# of Units	1	3	4
	Unit Cost	$45	$56	$57
	# of Units	1	2	4
Rem Start Yr	Active Remediation Start	**2003**	**2004**	**2005**
Closing Cost	Report	$34	$45	$67
	Probability of Success			
Abandonment	Abandonment Liability	$34	$45	$67
	Years to Abandonment	1	4	8
O&M	Operating Costs	$20	$80	$100
x	Operating Years	2	3	4
	Monitoring Cost	$24	$44	$99
x	Monitoring Years	5	10	20

Tornado Diagram - O1 Project)
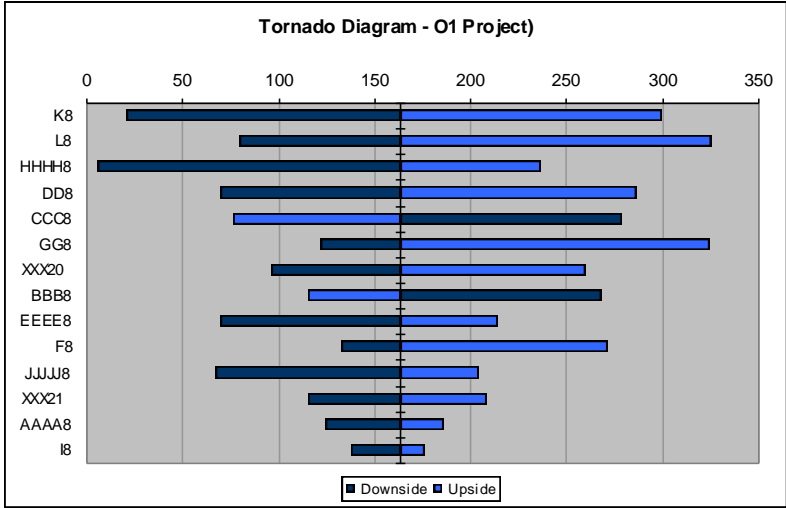
Crystal Ball® is used to generate individual alternative and overlay charts directly in EXCEL

- As alternatives are built, a simulation can be run and the results seen immediately
- The overlay chart is populated automatically as new alternatives are added and simulations are run
- Analytical results are combined with the framing, risk evaluation, and contingency paths to see the full picture

Overlay Chart
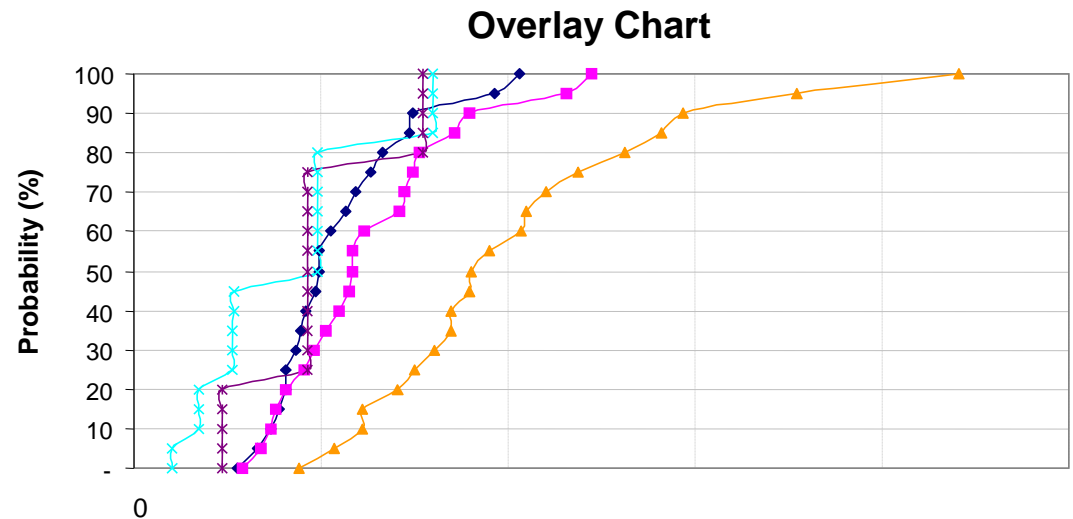
It is still more efficient and effective to model some elements of the problem with decision trees

Remediation Alternative A Low Cost; More Likely to Fail

Success 30% → A_Cost

Failure 70% → **Try B**
- **Success** 60% → A_Cost+B_Cost
- **Failure Use C** 40% → A_Cost+B_Cost+C_Cost

Use C → A_Cost+C_Cost

Risk and Contingency Evaluation Example
A_Cost=500000.
B_Cost=750000.
C_Cost=2000000.

Remediation Alternative B Higher Cost
- **Success** 60% → B_Cost
- **Failure: Use C** 40% → B_Cost+C_Cost

Remediation Alternative C Highest Cost; Almost Always Successful → C_Cost

- Trees (Treeage™) are used to model contingency pathways or evaluate options/trade-off questions
- Crystal Ball® is used to generate percentile outputs used for Decision Tree end nodes

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Key process enablers

- Expert facilitation to maintain focus in the workshop

- Technical consultants and management/project staff familiar with process

- Ability to pre-populate background data and preliminary cost estimates optimizes workshop time

- These are not one day DA's
  - There is considerable pre-work required to have a successful meeting
  - There is follow-up work to document results and confirm the analysis

Insights

The integrated process provides a framework for the decision and a means to help reach a decision that the entire team can agree on.

The evaluation results may be surprising.   With the team present, real time results often give rise to creative thinking about hybrid or additional options, to challenge a previous constraining decision, or to take a new direction altogether.

Use of the DA process helps makes strategic thinking a habit. Elements of the process (framing, alternatives development, quick decision trees, etc.), are used routinely in project team meetings to clarify strategy development for other sites in our portfolios.