

Making Hard Decisions
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Chapter 1

Introduction to Decision Analysis

Gypsy Moth and The Oda

In the winter of 1985, the ODA grappled with the problem of gypsy moth infestation in Lane County in Western Oregon. **Forest Industry representatives** argued strongly for an aggressive eradication campaign using potent chemical insecticides. The ODA instead proposed a plan that involved spraying most of the affected area with **BT (*Bacillus thuringiensis*)**, a bacterial insecticide known to be (1) **target-specific** (that is, it does little damage to organisms other than moths), (2) **ecologically safe**, and (3) **reasonable effective**. As well as using BT, the ODA proposed spraying three smaller areas near the city of Eugene with the Chemical Spray **Orthene**. Although Orthene was registered as an acceptable insecticide for garden use, there was **some doubt** as to its ultimate ecological effects as well as its dangers to humans.

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Gypsy Moth and The Oda - Continued

Forestry officials argued that the chemical insecticide was more potent than BT and was necessary to ensure eradication in the **most heavily affected areas**.

Environmentalists argued that the **potential danger** from the chemical spray was too great to warrant its use. **Some individuals** argued that spraying would not help because the infestation already was **so advanced** that no program would be successful. **Others** argued that an aggressive spray program could solve the problem once and for all, but only if done immediately. Clearly in making its final Decision the ODA would have to deal with many issues.

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Why are Decisions Hard?

- **Complexity**
 - Gypsy Moth Case: Three Objectives, Multiple Perspectives
- **Uncertainty of Key Elements**
 - Gypsy Moth Case: Size of the Infestation, Health Effect, Location of Gypsy Moth
- **Multiple Objectives**
 - Gypsy Moth Case: Target Specific, Ecologically Safe, Effective
- **Different Perspectives**
 - Gypsy Moth Case: Forestry Officials, Environmentalists
- **Sensitivity/Unstability**
 - Gypsy Moth Case: How sensitive is proposed solution to the size of the infestation

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Why Study Decision Analysis?

DECISION ANALYSIS:

- Supplies methods for organizing decisions
- Allows Identification of important sources of uncertainty
- Forces representation of uncertainty
- Supplies framework for dealing with multiple objectives
- Modeling and Sensitivity allows one to sort through the problem

LEADS TO BETTER DECISIONS:

- Decisions are consistent
- No surprises due to thorough study of the problem
- Performance of decision making is better on average

A GOOD DECISION:

- Looking back in the past, one can say that one would have made the same decision given the information available at the time of the decision

Why Study Decision Analysis? - Continued

DEFINITION DECISION ANALYSIS (DA):

- Prescriptive approach for people who want to think hard and systematically about decision problem

COMMENTS DECISION ANALYSIS:

- A DA is an information source
- Should not replace the decision maker but support him/her
- A DA does not only provide a solution, but also insight into
 - Situation
 - Uncertainty
 - Objectives
 - Trade offs

**DECISION ANALYSIS CAN ONLY YIELD
A RECOMMENDED COURSE OF ACTION**

Subjective Judgments and Decision Making

IMPORTANT INPUTS FOR DECISION ANALYSIS:

- Subjective judgments about uncertainties
- Subjective judgments about preferences

**REQUIREMENT OF SUBJECTIVE JUDGEMENT FOR
DECISION ANALYSIS CAN BE CONSIDERED BOTH
A STRENGTH AND A WEAKNESS**

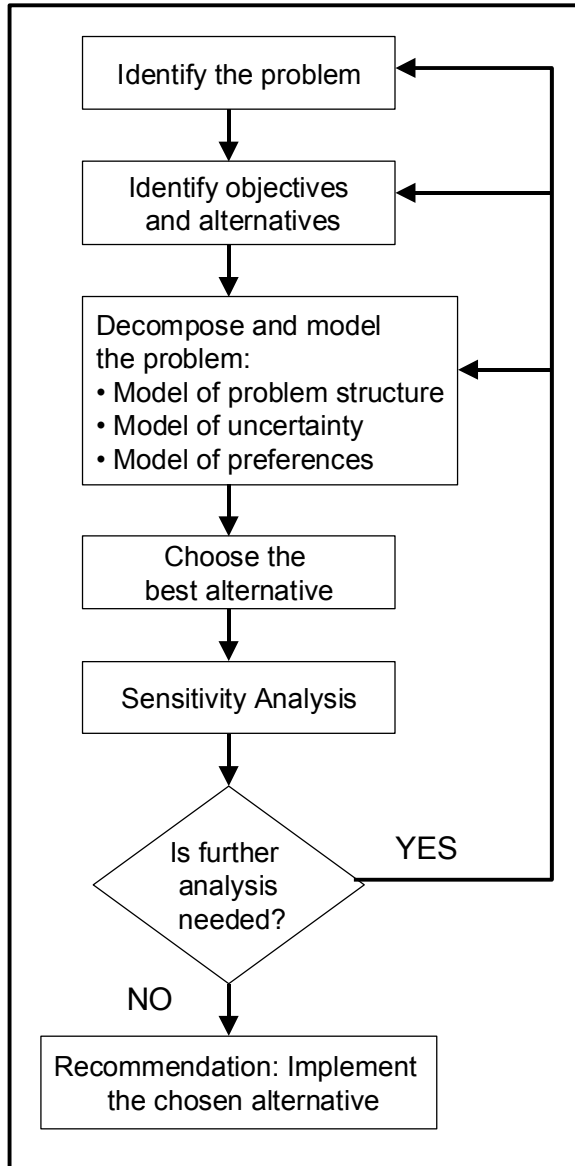
STRENGTH:

- Does not ignore subjective judgments prevalent in other management science techniques

WEAKNESS:

- **BE CAREFULL**, human beings are imperfect information processors

The Decision Analysis Process



Identify:
Address problem
or keep people happy

Objectives:
Min. cost? Max. profit?
Min. risk?
Max. market share?

Alternatives:
Invest, not invest?
Partially invest?
Attack, not attack?
Partially attack

Decompose:
“Divide & Conquer”
Mathematical Models
are helpful.

Sensitivity:
“What if?”
Does optimal decision
change?

Further Analysis:
New objectives?
New Alternatives?
Changed insight in
uncertainties?
Changed insight in
preference?

Requisite Decision Models:

“A Model is requisite if no new intuitions emerge about the problem or when it contains everything essential for solving the problem” , Phillips (1982, 1984)

Convergence to Requisite Decision Models:

- Technical Modeling Expertise
- Will of the Decision Maker (DM) not to accept incomplete or inappropriate models

Where is Decision Analysis Used?

BUSINESS & GOVERNMENTS:

- Managing research and development programs
- Understanding the world oil market
- Forecasting sales of a product
- Electric power generation
- Deciding whether to launch a new product or venture

MEDICINE:

- Help doctors make specific diagnosis
- Optimal inventory of blood levels in a blood bank
- Firm's decision regarding different kinds of medical insurance programs

Corner and Kirkwood (1991) – “Decision Analysis Application in the Operations Research Literature,”
***Operations Research*, Vol. 39, pp. 206-219**

Where Does the Software Fit In?

DecisionTools Program	Where It Is Used in the Decision Process	Where in the Text
Precision Tree	Structuring the decision	Chapter 3
	Solving the decision	Chapter 4
	Sensitivity analysis	Chapter 5
	Value of information	Chapter 12
	Modeling preferences	Chapter 13
TopRank	Sensitivity analysis	Chapter 5
RiskView	Modeling uncertainty	Chapter 8 and 9
BestFit	Using data to model uncertainty	Chapter 10
@RISK	Simulation Modeling	Chapter 11

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Where Are We Going from Here?

MODELING DECISIONS:

- Structuring Decision - Chapters 2 & 3
- Analyze Decision Models - Chapter 4
- Sensitivity Analysis - Chapter 5
- Creativity and Decision Making - Chapter 6

MODELING UNCERTAINTY

- Basic Probability Review - Chapter 7
- Expert Judgment - Chapter 8
- Theoretical Probability Models - Chapter 9
- Data-based Probability Models - Chapter 10
- Simulation - Chapter 11
- Value of Information - Chapter 12

MODELING PREFERENCES

- Modeling Risk Attitude - Chapters 13 & 14
- Multi objective decision making - Chapters 15 & 16