



*Applying Analytical Methods to  
Make Better Decisions*

## Decisions, Decisions . . . How to Evaluate Risks and Uncertainties

Prepared for Presentation to

William Gains Ellyson

March 2006 Client Meeting

by

Jeff Horton

Principal, Consulo Group LLC

[jlhorton@consulogroup.com](mailto:jlhorton@consulogroup.com)

## Agenda

- Survey
- Intro & Objectives
- Decision Making
- Decision Biases
- Uncertainty
- Risk
- Flexibility
- Wrap-up

## Introduction

- About me
  - B.S./M.S. Engineering w/concentration in Operations Research, The Pennsylvania State University
  - M.B.A. (2001), The Fuqua School of Business at Duke University
  - Certified Project Management Professional (PMI/PMP), Member Institute for Operations Research and the Management Sciences & Professional Risk Managers' International Association
  - Over 20 years experience as an engineer, analyst, IT project manager and business manager working in the areas of commodity sourcing/trading, business strategy/planning, capital project development and asset acquisitions in a Fortune 500 corporate setting.
  - Three years experience as a consultant and small business owner
  - Expertise in analytical methods/modeling, forecasting, market analysis, IT project management, commodity procurement/trading, fossil and nuclear fuel, power generation, facility siting, deal origination/structuring, contract negotiations, strategy and business planning, risk assessment, asset acquisition due diligence and valuation.

## Introduction

- About Consulo Group & Prior Consulting Experience
  - Formed in late 2005, as successor to Synergy Partners, Inc. (co-founded with Duke classmate in 2003)
  - What does Consulo Group do:
    - Financial Planning & Analysis – CF models, pro forma's, forecasts, feasibility studies supporting business planning & investment decisions.
    - Decision Modeling – apply analytical methods, develop models using spreadsheet and DB tools
    - Risk Assessment – assess uncertainty, identify risk exposures and potential management approaches
    - Management Consulting – market analysis, process improvement, business strategy & planning
    - Education – analytical methods/modeling, uncertainty/risk assessment, decision making
  - Seek to complement & work with other business advisors
  - Prior experience with small business and non-profits/associations
- For more see web site [www.consulogroup.com](http://www.consulogroup.com)

## Our Objectives Today

- To discuss key elements of decision making and the importance of recognizing common biases
- To discuss uncertainty and risk management in long-term decision-making.
- To provide information useful ways to assess and manage uncertainty and risk.

## Decision Making

### Decisions verses outcomes

- Uncertainty creates the potential for alternate outcomes
- Desirability of outcomes is influenced by consequences
- Decisions have varying levels of influence on outcomes
- Many decisions set the stage for a series of sequential and/or parallel additional decisions
- “Maintaining the status quo” in the face of uncertainty is a decision to either
  - Confirm the status quo as the best strategy
  - “Stay the course” (defer) until uncertainty further resolves
  - Ignore uncertainty

## Decision Making

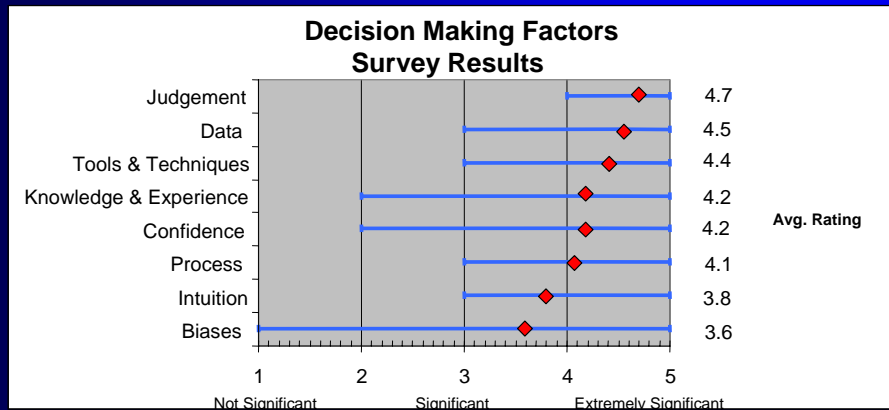
- What are the characteristics of a good decision?
  - Consistent with business objectives and values
  - Maximizes opportunity for favorable results under potential uncertainties consistent with business risk tolerance
  - Time and resources applied to decision consistent with potential value and risk exposure

## Decision Making

- What factors support good decision making?
  - Having applicable business knowledge and experience
  - Having good “judgment”
  - Having good Intuition
  - Having applicable information
  - Having and applying a good decision process
  - Knowledge of, and appropriate application of tools and techniques

0

## Survey Results Decision Factors

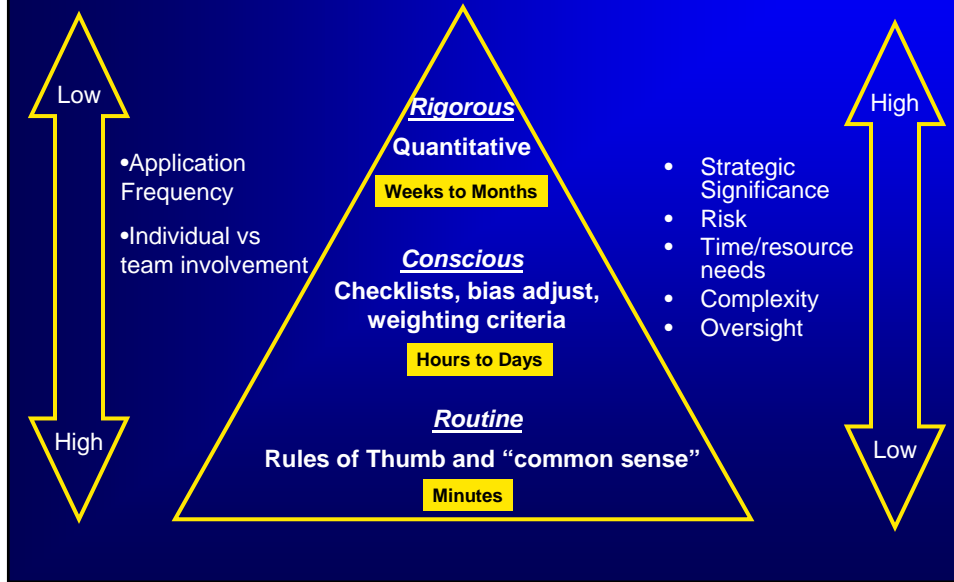


U

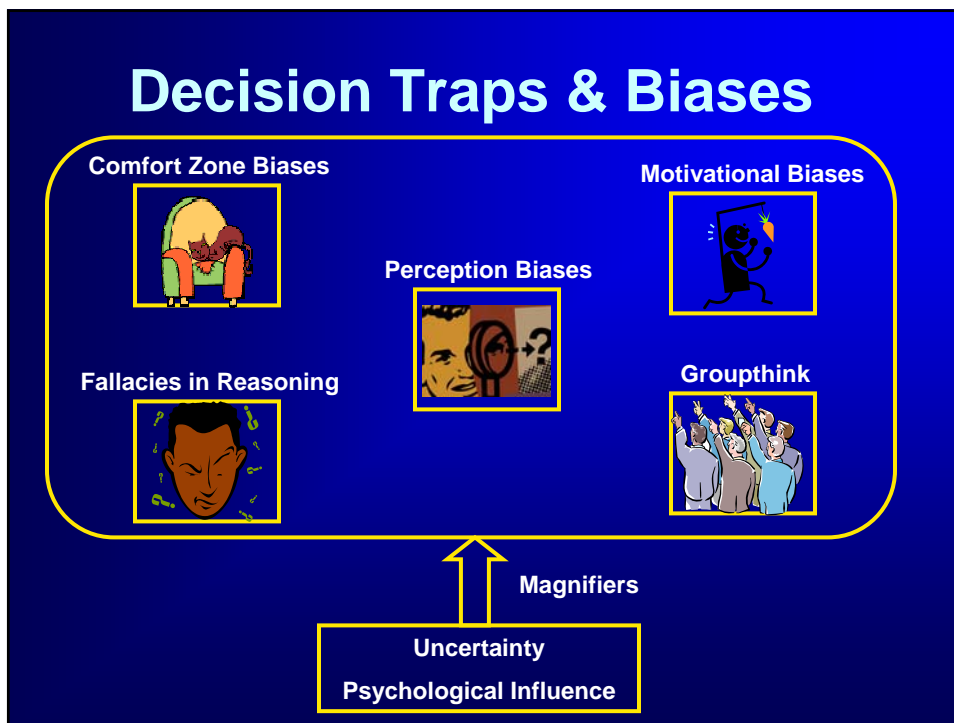
## Decision Making

- What factors make decision making more challenging?
  - Uncertainty
  - Complexity
  - Inaccurate information
  - Time and resource constraints
  - Conflicts (objectives, decision criteria, interest, values/ethics)
- What factors significantly influence a decisions *intended* impact on future outcomes?
  - Execution
  - Adaptation

# Decision Making Hierarchy









# Decision Traps & Biases



## Influence Mechanisms (see handout)

- **Rule of Reciprocity**
  - We should repay in kind what another provides us
- **Commitment and Consistency**
  - Once we make a choice or take a stand, we encounter personal and interpersonal pressure to behave consistently with that commitment
- **Social Proof (Conformity)**
  - When in doubt, copy what others do
- **Liking**
  - We prefer to say yes to people we know and like
- **Authority**
  - We are more likely to concede to a request from an authority figure
- **Scarcity**
  - Opportunities seem more valuable when less available

## Select Bias Examples (see handouts)

- Overconfidence 
- Availability 
- Anchoring 
- Framing  
- Escalation of Commitment
- Representativeness 
  - Law of small numbers
  - Misconceptions of chance
- Groupthink

## Survey Results Overconfidence

% Confidence	% Misses			Overconfidence Factor
	Ideal	Actual	Diff.	
90% - Very Confident	10%	25%	15%	2.5
80% - Confident	20%	60%	40%	3.0
70% - Somewhat Confident	30%	37%	7%	1.2
60% - Not Very Confident	40%	56%	16%	1.4
50% - No Idea	50%	50%	0%	1.0

U

## Survey Results Anchoring

		Annual Salary Estimate		
		<u>Avg</u>	<u>Min</u>	<u>Max</u>
<b>India Living Std</b>				
Survey A Anchor	16%	24%	10%	65%
Survey B Anchor	82%	72%	50%	90%
<b>Engineer Salary</b>				
Survey A Anchor	45K	63K	35K	80K
Survey B Anchor	85K	72K	55K	90K

U

## Survey Results

### Availability

- **Which of the following resulted in more deaths in the U.S. in 2000?**
  - A. White males, age 20-24, who died from intentional self-harm (suicide)
  - B. Black males, age 20-24, who were killed in homicides
  - Correct answer: A
  - Survey: 75% answered B
  - Why? B more reported in media, more “dramatic”, more “attention getter”



## Survey Results

### Representativeness

- **Law of Small Numbers – Hospital Question**
  - . . . In the larger hospital about 45 babies are born each day and in the smaller hospital about 15 babies are born each day. . . . For a period of one year, each hospital recorded the days in which more than 60% of the babies born were boys. Which hospital do you think recorded more such days?
    - A. The larger hospital
    - B. The smaller hospital
    - C. About the same (that is, within 5% of each other)
  - Correct answer: B
  - Survey: 55% answered incorrectly
- **Misconceptions of chance – Rare Disease Question**
  - . . . incidence of the disease in the general population is .01% (only 1 out of every 10,000 people will contract the disease). You are also told that the accuracy of the test is 95% (5 times out of 100, the test result is wrong - false positive). The test comes back positive. What is the probability that you have the disease?
    - A. 95% , B. 90%, C. 82%, D. 56%, E. 19%
  - Correct answer is E
  - Survey: 1 person answered correctly



# Managing Biases

- How to mitigate bias impacts
  - Educate yourself and staff about common biases and decision traps and physiology of influence
  - Understand what biases are most significant relative to the level of decision and stage in the decision process.
  - Consider multiple frames and opinions
  - Use a more structured process (checklists, weighting criteria)
  - Periodically calibrate
    - Keep better ongoing record of estimates verses actual
    - Fast feedback
    - Remember *experience is inevitable, learning is not*
  - Don't question your decision making ability, but more critically challenge your assumptions
    - Ask more questions of yourself and others
    - Acknowledge what you don't know (uncertainty)
  - For groupthink: see handout and later discussion

*"It's not what you don't know that gets you in trouble.  
It's what you know that ain't so"*

Will Rogers

*"Real knowledge is to know the extent of one's  
ignorance."*

Confucius

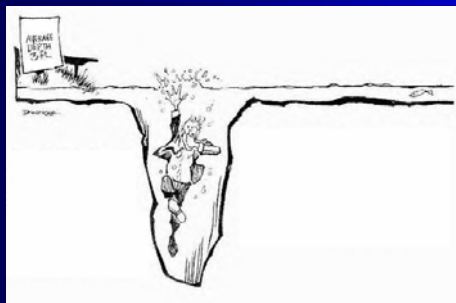
*" I have never let my education interfere with my  
learning"*

Mark Twain

# Uncertainty

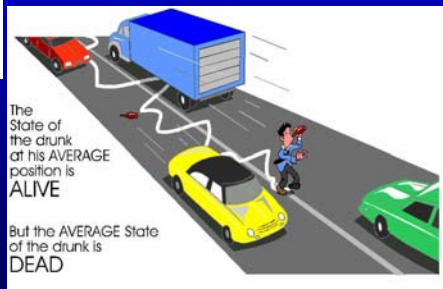
- What is uncertainty?
  - A variable or event whose future value or outcome is not known with certainty in advance.
  - May have a well defined or completely unknown probabilistic nature.
    - Perfectly definable: coin flip, roll of dice
    - Well defined: defect rates in manufacturing process
    - Reasonably definable: next days local weather
    - Poorly definable: likely competitor response to a new product introduction
    - Undefinable: many politically driven events, path of a pinball, direction of Jeff's golf ball off tee

## Best Value = Expected Value?



Plans based on *average* conditions are often wrong on *average*

### The Flaw of Averages



## Uncertainty – Comparison of Assessment Methods

Method	Comments	Pros	Cons
Management/ "Expert" Estimates	Judgmental, frequently used/misused	Uses "best informed" sources. Can be timely and require little expense.	Susceptible to bias. Limited insight/future process value.
Trial & Error/ Experimentation	Judgmental/ Quantitative	Can lead to more direct quantification.	Can be complex, time consuming, expensive
Sensitivity	Judgmental/ Quantitative	Can lead to more direct quantification	Doesn't capture interrelationships well.
Scenarios	Judgmental/ Quantitative	Can lead to more direct quantification. Can be visualized more readily. Can promote broader thinking of alternatives	May be hard to reach consensus. Danger of "speculative imagination"
Decision Analysis	Quantitative/ Judgmental	Integrates alternative and probabilities. Good software tools available.	Can be time consuming and higher skill levels needed for complex application.
Simulation	Quantitative/ Judgmental	Handles complex situations. Allows integration of multiple approaches. Good software tools available	Can be time consuming and higher skill levels needed for complex application

## Uncertainty – Judgmental Methods

- If there is readily available data, use it
  - Remember 80/20 rule
- Tools and techniques
  - If uncertainty involves actions of people try to assess intentions (competitive intell., surveys, role play)
  - Use "expert" opinion (with caution)
  - Use survey approaches
    - Only survey those knowledgeable in subject matter
    - Consider Delphi Technique
    - Avoid traditional meetings
  - Create independent estimation teams
  - Decompose the uncertainties, if complex

# Uncertainty – Judgmental Methods

- Guidelines for Better Estimates
  - Good models usually beat good “experts” (if time/data/budget, significance allow)
  - Multiple low level experts usually beat “guru’s”
  - Seek disconfirming information
  - Generate multiple scenarios
  - Seek counter arguments (“devils advocates”)
  - Seek multiple views from independent sources – then aggregate (Groups come up with better estimates than individuals)
  - Understand group dynamics
    - Develop strategies to avoid “groupthink”

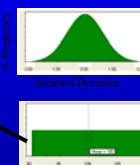
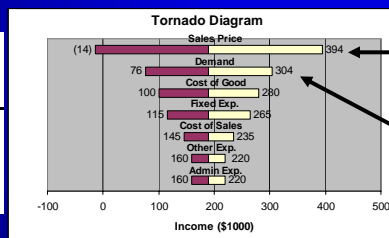
# Sensitivity Analysis

- What is Sensitivity Analysis (sometimes called “What-if Analysis”)?
  - Determination of how changes in input variables impact key evaluation criteria

**Sensitivity Summary**  
(Sensitivity of P/L forecast to +/-10% change in assumption)

Revenue		Cost			
Assumptions	Downside	Upside	Assumptions	Downside	Upside
Sales Price	(14)	394	Cost of Good	100	280
Demand	76	304	Fixed Expenses	115	265
			Cost of Sales	145	235
			Admin Exp.	160	220
			Other Expenses	160	220

BASE CASE EXPECTED NET INCOME = 190



- The question list:
  - Look at the +/- change
  - Is the range of outcomes realistic?
  - What do you know about the probabilities? What is the shape of the uncertainty?

## Sensitivity Analysis

- Why do it?
  - Identifies what variables are significant/immaterial to decision
  - Helps determine level of time/effort to get more information
  - It sets stage for next level analysis
  - Useful to develop scenarios
  - Results are understandable and easily explainable
  - It's easy (especially with software tools)
  - May not have time for anything else

## Sensitivity Analysis

- Issues
  - Simple analysis do not reflect key variable inter-relationships or likelihood of outcomes
  - The variable to criteria relationship may be linear, non-linear, step-function
  - Understanding long term, short term, specific time-frame and cyclical changes
- Software Tools (Excel Add-Ins, see handouts)
  - CrystalBall™
  - TopRank

## Risk

- What is Risk?
  - Deviation from the expected
    - Resulting outcome may be favorable or unfavorable
    - Described by the significance of the consequences of a deviation
    - Subject to management
- Risk/Return trade-off
  - No risk - no return
  - Do two alternatives have the same expected return, but different risk?

## Risk – Issues and Process

- Time transforms risk
  - Nature of risk is shaped by the time horizon
  - In decision-making time matters most when:
    - Decision is irreversible
    - Uncertainty present
    - Consequences significant
- How do we manage risk? (Steps in the process)
  - Identify uncertainties
  - Analyze and understand the impacts of these uncertainties
  - Identify means to mitigate or exploit (Downside and Upside)

## Risk Management Techniques

- Techniques to mitigate or exploit
  - Avoid
  - Transfer
  - Retain
  - Share
  - “Manage”
    - Reduction and control techniques
    - Hedge
    - Active recognition and utilization of **flexibility**

## Risk - Comparison of Assessment Methods

<u>Method</u>	<u>Comments</u>	<u>Pros</u>	<u>Cons</u>
Risk Profiling (risk tolerance)	Judgmental	Can be developed at project, business unit, company level.	Simplistic, subject to bias
Risk Mapping	Judgmental/ Quantitative	Provides good intuitive assessment.	Needs to be facilitated to stay focused.
Decision analysis with utility curves	Quantitative	Explicit quantification of uncertainty/risk and flexibility in decision process	Can become complex and time consuming in advanced applications
Discounting	Quantitative	Explicit quantification of market risk for discounting CF	Doesn't explicitly address private risk issues
Enterprise Risk Thinking	Process: the enterprise as a portfolio of projects	Integrates value creation and risk management process.	Requires significant resources to “get off ground”

## Overview of Flexibility

- What Is Flexibility?
  - The ability to “change course” mid-stream
- Examples of Flexibility
  - Increase/decrease output as “demand” warrants
  - Delay expansion until favorable conditions exist
  - Having ability to switch timing, feedstock, production, markets
  - Having ability to extend/expand, pull back or exit a contract obligation (often tied to cap/floor price, cost or performance factor)
  - Adjust marketing activities
  - Implement projects in phases to resolve uncertainty and “stage” resources

## Overview of Flexibility

- How Do You Derive Value From Flexibility?
  - Active, *not passive*, management.
    - Recognize opportunities where uncertainty and significant potential cash flow volatility are present
    - Pro-actively identify and assess alternatives to mitigate downside and take advantage of upside potential.
    - Develop and implement options and *means* to execute
- Can we use traditional static analysis to evaluate?



# Flexibility Assessment Methods

- Scenarios
  - Alternate deterministic “states of the world”
  - May give rise to “contingency plans”
- Decision Trees
  - Alternative decision paths within discrete probabilistic framework
  - Can address timing considerations
- Options “Thinking”
  - Strategic, risk management, and valuation process / method
  - Recognizes value of flexibility in face of uncertainty
  - Explicitly provides decision framework through time



# Scenario Analysis

- What is it?
  - Envisioning potential alternate “states of the world” (not a forecast per se)
  - Typically focused on identifying a realistic least favorable and most favorable set of conditions that may impact decision
- Why do it?
  - Useful to “stress test” your potential decisions or strategy
  - Useful to support identification of flexibility to create option value
  - Useful to support development of risk management strategies

## Wrap –Up

- Frame your decisions properly and apply the appropriate decision process
- Recognize biases and influence mechanisms
- Don't forget the "flaw of averages" – recognize uncertainty
- Remember value creation involves maintaining a balance between risk and reward
- Flexibility has value – mitigate downside and position for upside
- Use scenario analysis and develop contingency plans
- Execute!!!
- See reference sheets for more info

Consulo Group LLC  
jlhorton@consulogroup.com  
www.consulogroup.com  
804-304-4224

Free Telephone Consultation for questions on:  
Analytical Methods  
Spreadsheet Modeling