Presenting:

Multi-Criteria Tools and DA
by Paul Davis

DAAG Conference 2003

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Multi-Criteria Tools and DA

2003 DAAG - Decision Models on the Fringe of DA

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Abstract

- Decision analysis is recognized for the ability to assist with complex problems incorporating risk; however it is often challenging to communicate results to decision makers whose typical exposure to DA is limited to tornado diagrams and S-curves. This is further complicated when additional decision criteria that are more difficult to quantify are incorporated into the decision making.

- ChevronTexaco's ERTC Decision Analysis Support team have used the Criterium ® DecisionPlus ® tool to help decision makers successfully grapple with multi-attribute decision making. The graphical features of the tool help decision makers visualize the impact of risk elements and risk weighting on decision making. Examples will be discussed where the tool has been used successfully to supplement traditional DA analysis.

Case Study 1 – Property Management

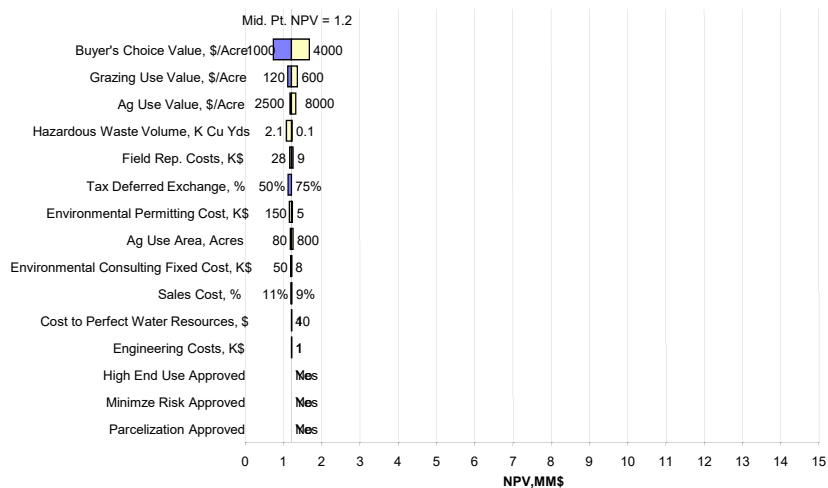**Extracting Value from Former Oil/Gas Properties**

- Traditional Decision Analysis
  - Framing, Strategy Identification
  - Influence Diagrams, Economic Modeling
    - Tornado Diagrams, S-Curves, Value of Information

- What about the "Soft Stuff"
  - More than the NPV
  - What about Environmental Risk and Public Opinion?

- We have found good visual multi-criteria tools helpful
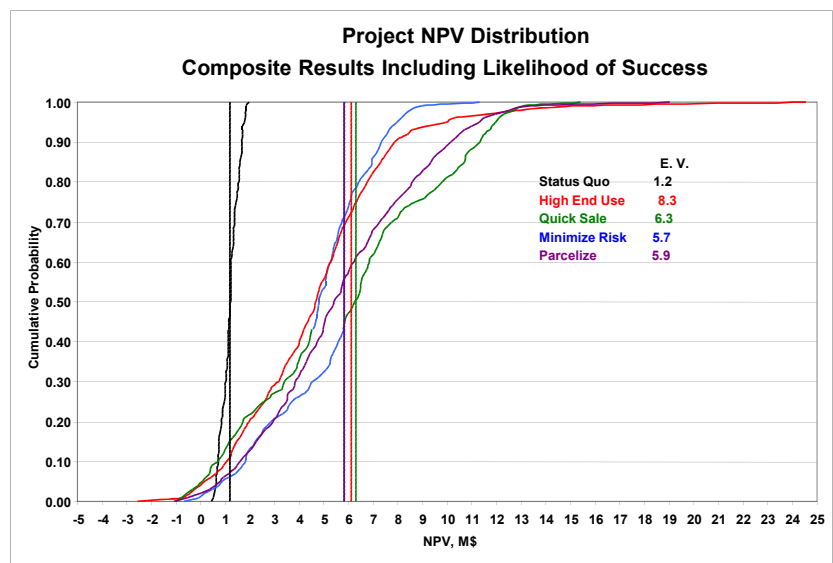
End-use Options Considered

- **Status Quo** - Maintain current property management strategies to minimize future risk and liability.

- **High End Use** – Develop property for high end use to maximize NPV and increase shareholder return.

- **Quick Sale** - Exit asset as expeditiously as possible.

- **Minimize Risk** – A strategy that minimizes liability with a mix of property management and selective property development to increase NPV and shareholder return.

- **Parcelize** – Target properties for selective use in parcel increments.

Traditional DA Evaluation

Status Quo

Mid. Pt. NPV = 1.2

Parameter	Low	High
Buyer's Choice Value, $/Acre	1000	4000
Grazing Use Value, $/Acre	120	600
Ag Use Value, $/Acre	2500	8000
Hazardous Waste Volume, K Cu Yds	2.1	0.1
Field Rep. Costs, K$	28	9
Tax Deferred Exchange, %	50%	75%
Environmental Permitting Cost, K$	150	5
Ag Use Area, Acres	80	800
Environmental Consulting Fixed Cost, K$	50	8
Sales Cost, %	11%	9%
Cost to Perfect Water Resources, $		40
Engineering Costs, K$		1
High End Use Approved	No	Yes
Minimze Risk Approved	No	Yes
Parcelization Approved	No	Yes

NPV,MM$ (0 – 15)

High End Use

Mid. Pt. NPV = 9.5

Parameter	Low	Mid	High
Residential Use, K$/Unit	125	250	350
Residential Sales, Units	90	150	243
Residential Dev Start, Year	2015	2010	2007
Offsite Cost, K$	10000	2000	1000
Ag Use Value, $/Acre	2500	3875	8000
Basic Devel Cost, K$/Lot	120	89	70
Oily Soil Volume, K Cu Yds	300	100	75
Residential Adsorption Rate, Units/Yr	12	24	52
Oily Soil Treatment Cost, $/Cu Yd	44		14
Land Fill Profit Share, % of Tip Fee	3%		10%
Land Fill Dump Fee, $/Ton	12		30
Tax Deferred Exchange, %	50%		75%
Ag Use Area, Acres	1100		1700
Landfill Approved	No		Yes
Grazing Use Value, $/Acre	120		600

NPV,MM$ (0 – 15)

Project NPV Distribution
Composite Results Including Likelihood of Success

	E. V.
Status Quo	1.2
High End Use	8.3
Quick Sale	6.3
Minimize Risk	5.7
Parcelize	5.9

Cumulative Probability vs NPV, M$

Difficult to Quantify Issues

	Categories		**Individual**
30%	Environmental	10%	3rd Party damage suits
		10%	Natural resource damage
		10%	Political risks
10%	Opinion	5%	Public Opinion
		5%	Agency support
60%	Economic	60%	NPV

Identified and Weighted by Decision Review Team

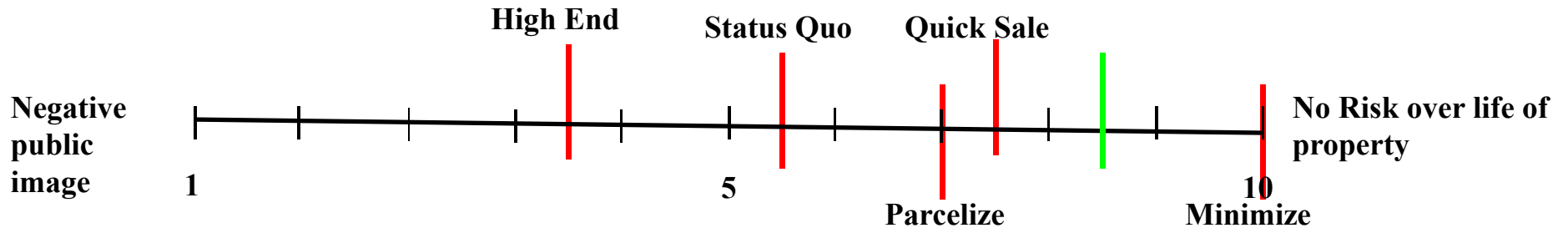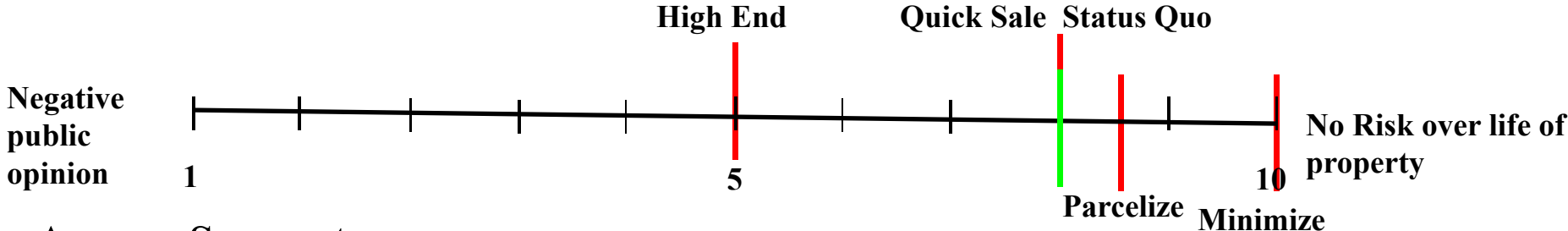# Potential Impact of Value Measures
Assessed by Project Team

Third Party Damage Suits
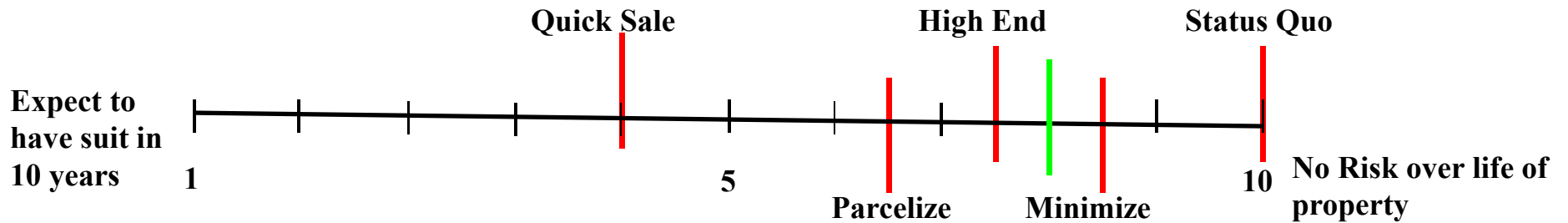
Quick Sale   High End   Status Quo

Expect to
have suit in
10 years

1   5   10   No Risk over life of
                                       property

Parcelize   Minimize

Natural Resource Damage

High End   Status Quo   Quick Sale

Expect to
have suit in
10 years

1   5   10   No Risk over life of
                                       property

Parcelize   Minimize

Political Risks

High End   Status Quo   Quick Sale

Negative
public
image

1   5   10   No Risk over life of
                                       property

Parcelize   Minimize
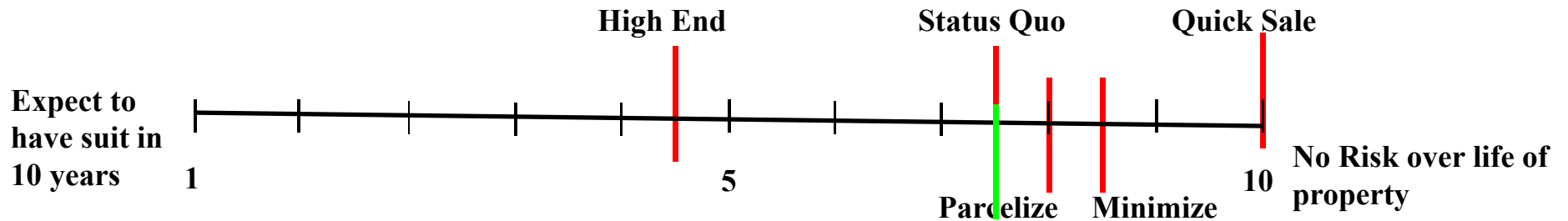
Potential Impact of Value Measures
Assessed by Project Team

Public Opinion

High End   Quick Sale Status Quo

Negative public opinion   1   5   Parcelize Minimize   10   No Risk over life of property

Agency Support

High End   Status Quo Quick Sale

Adversarial   1   5   Parcelize   10   Minimize   Positive Relationship

NPV Expected Value, M$

Status Quo   Quick Sale   High End

1   5   Minimize Parcelize   10
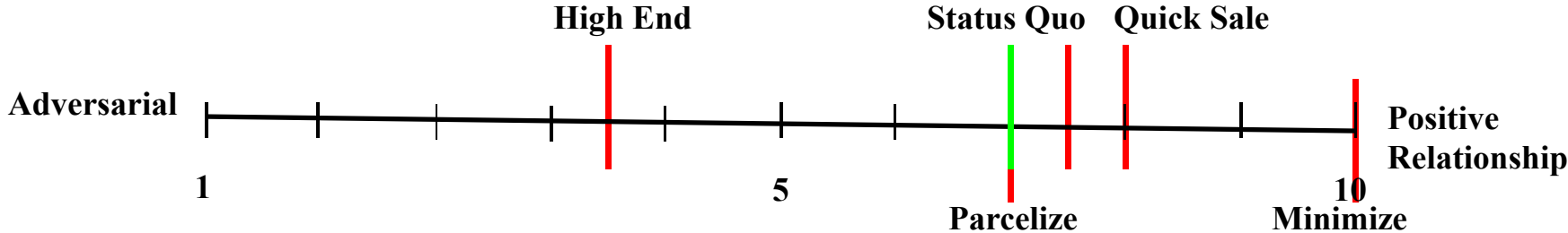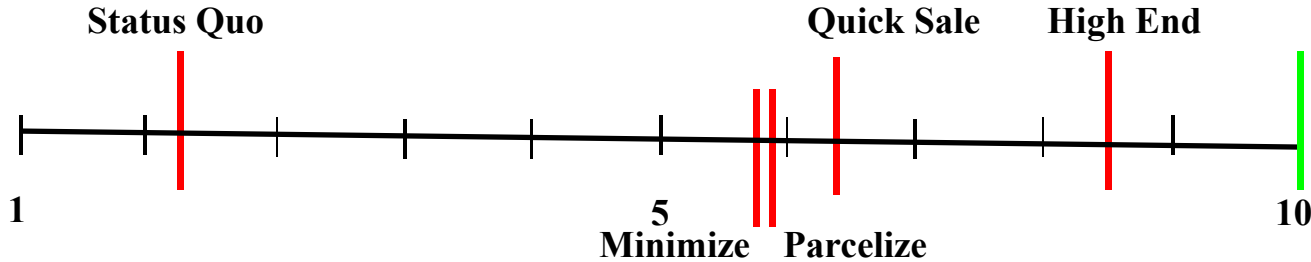
Multi-criteria Decision Scores
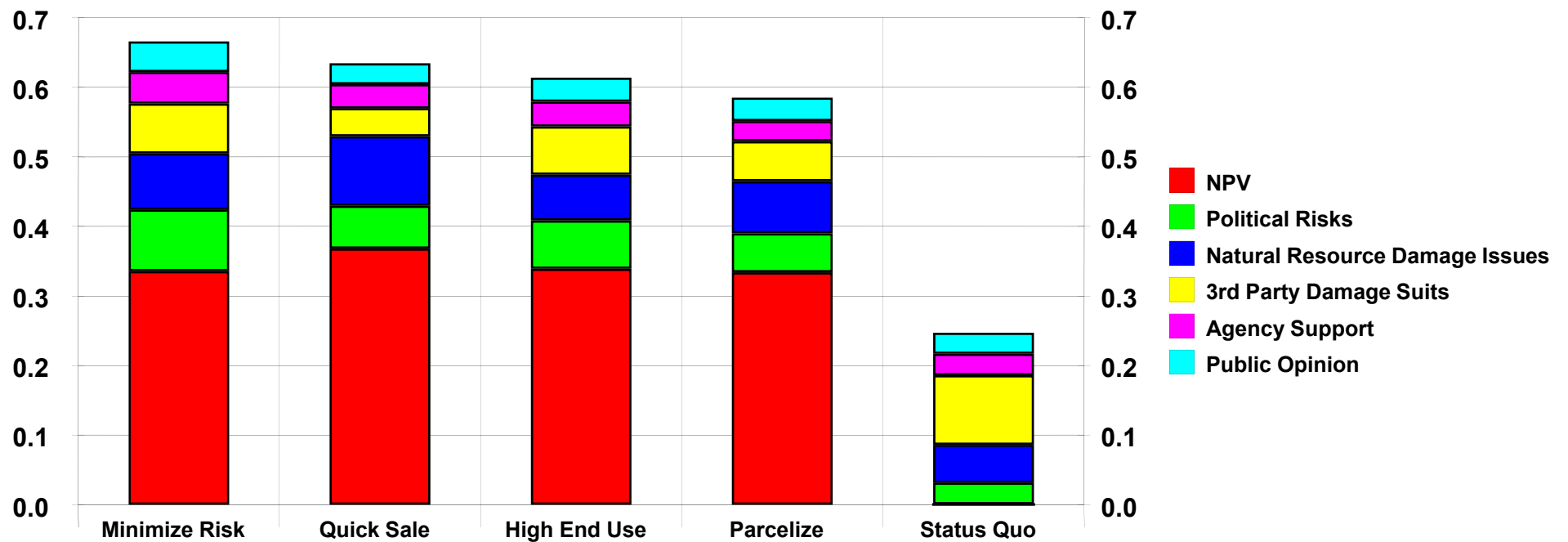
Multi-criteria Scores
Impact of weight on Expected Value NPV

Sensitivity to Goal - NPV

Minimize Risk   **Quick Sale**

Alternatives:
Minimize Risk
Quick Sale
High End Use
Parcelize
Status Quo

Decision Scores

Changing Weight on NPV to above 75 % switches to Quick Sale

0.9

0.0

0.0   priority value   1.0

Temp Value:
0.60(Important)
Current Value:
0.60(Important)
Note: The most critical 5 alternatives are shown.
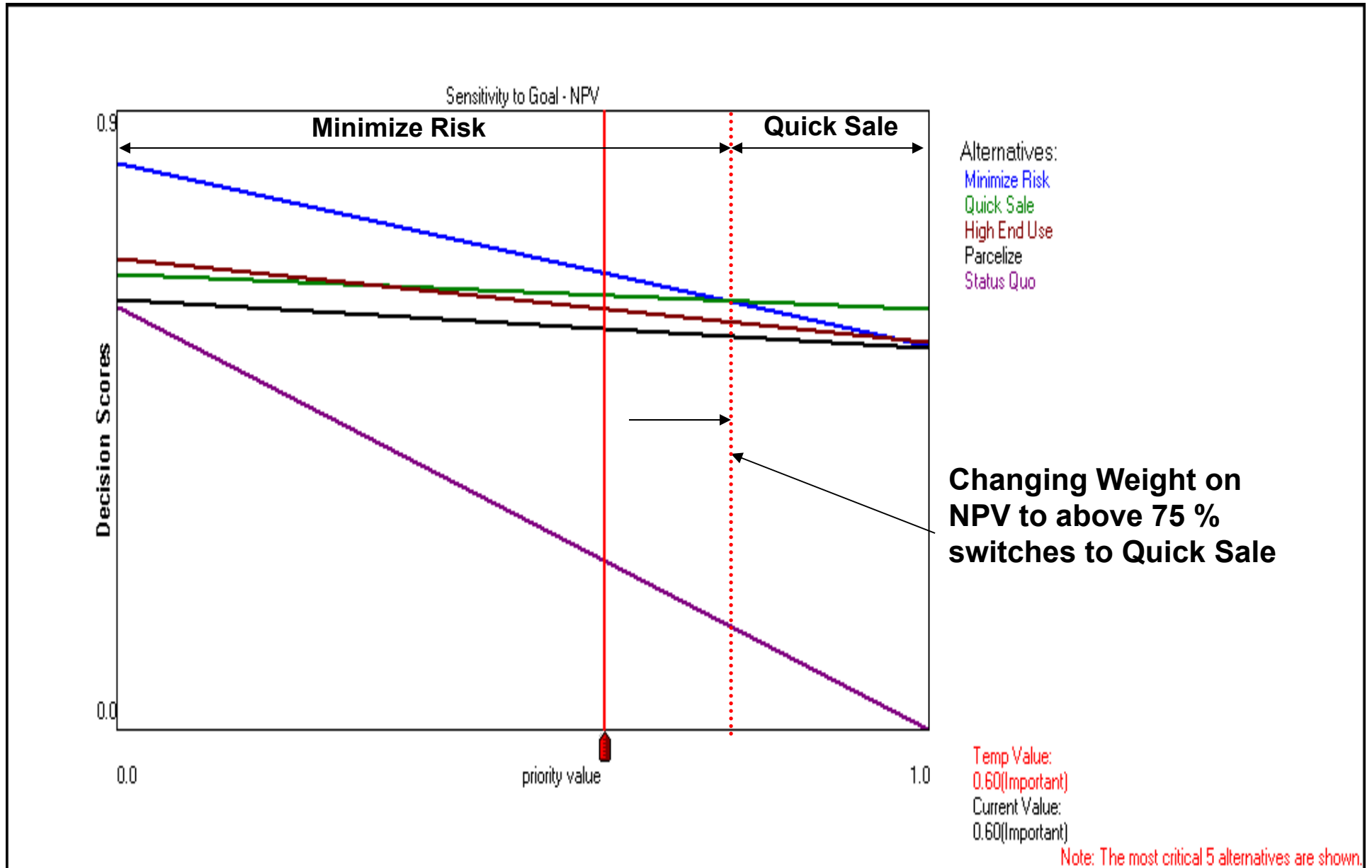
Multi-criteria Scores
Impact of weight on 3rd Party Damage Suits

Sensitivity to Goal - 3rd Party Damage Suits

Minimize Risk   Status Quo

1.0

Decision Scores

Alternatives:
Minimize Risk
Quick Sale
Status Quo
Parcelize
High End Use

0.0

0.0   priority value   1.0

The weight on 3rd party damage suits would have to be increased to 65% to switch from Minimize Risk to Status Quo

Temp Value:
0.10(Trivial)
Current Value:
0.10(Trivial)

Note: The most critical 5 alternatives are shown.

Did This Help?

- **Decision Makers Think So**
  - Helps visualize the Risk Factors
    - Identify What Is Important – What to Mitigate
  - Helps understand the Impact of weighting on the factors
    - No impact or large move required – Move On
    - Small move changes decision – Mitigation? More Evaluation?
    - Can quantify impact of other decision criteria

  - Could these factors be modeled with Traditional DA
    - Probably, but…
    - Sometimes the value is more in the dialogue than the numbers

- **DA without effective Communication is not effective**

Case Study 2 – Financial Services

- ## How to provide services?
  - – In-house, Out-source, Offshore
- ## Which services belong in which bucket?
  - – How to add rigor to sorting and prioritization
  - – Lots of factors and risk elements to understand
- ## DecisionPlus - a tool for organizing, completing and communicating complex decisions. Proposed Process:

  1. Criteria (**How to decide**) and alternatives (**Which services**) are selected
  2. Criteria identified as core (high level) or secondary (details)
  3. Criteria are weighted – by the DRB
  4. Alternatives are rated relative to each criteria – by the team
  5. Data is analyzed - Alternatives are scored and ranked, sensitivities, etc.

Financial Services - Characterization

**Team** - characterizes service relative to each other
DRB - sets relative weighting of risk

Critical level

- Discretionary judgment
- Tight deadlines
- Controls

- Cash /P&L impact
- Confidential info
- Tax/ regulatory issues
- Government reporting

Complexity

- Unique skills
- System support availability
- Stable process

- Data readily available
- Variable workload
- Electronic processing

Customer interface/ business knowledge

- Co-location
- Oral communication
- Real time interaction

- Opportunity for value added
- Face to face interaction
- Business knowledge needed
- JV partner interface

Illustrative Results
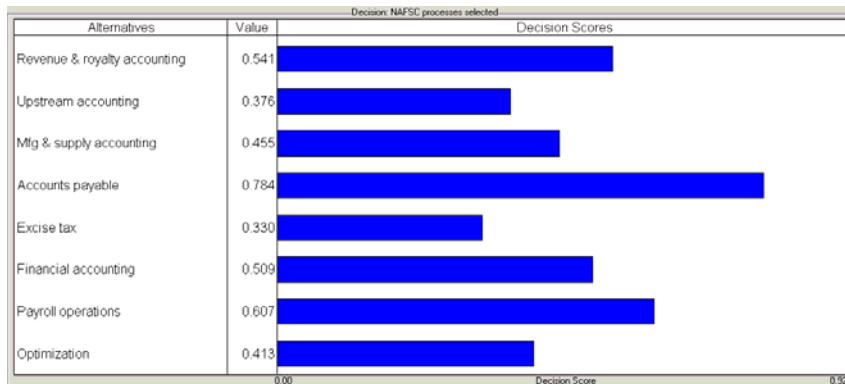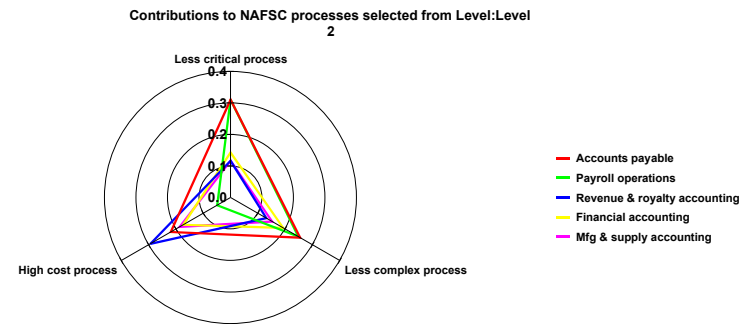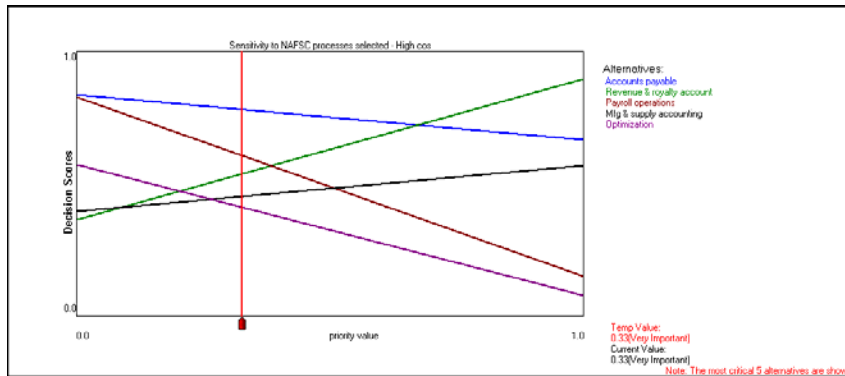## How should each service be provided?

Contributions to financial service processes selected
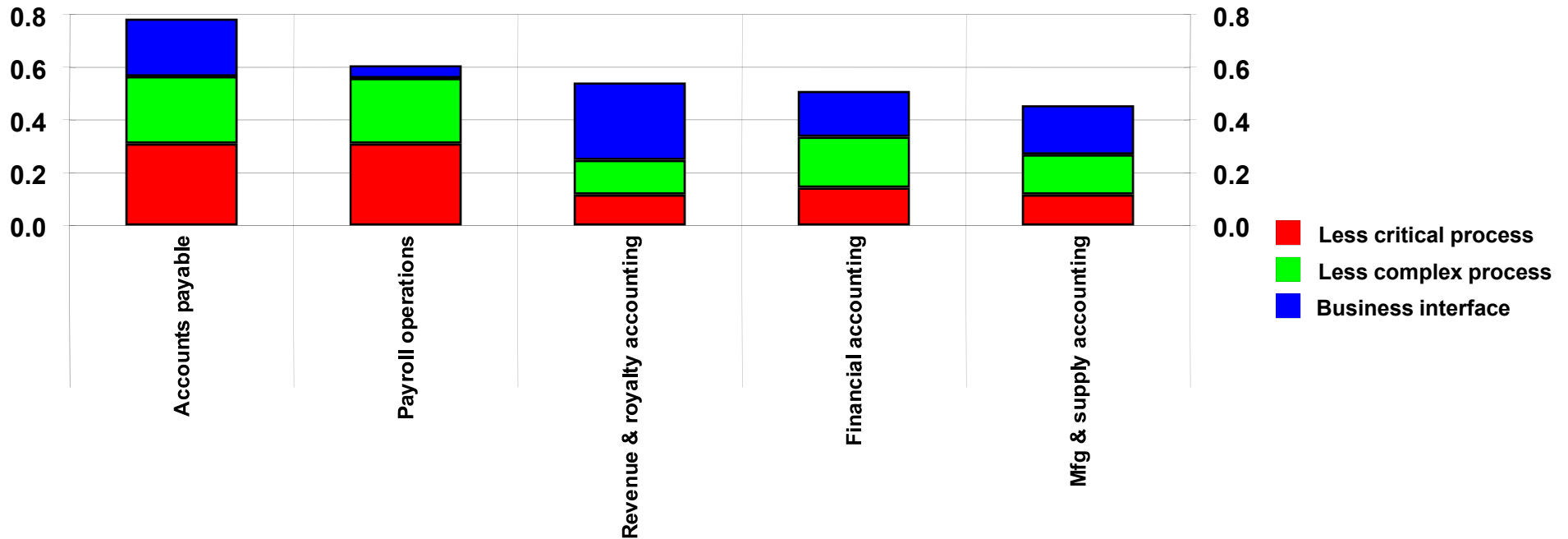
- # What does this tell decision makers?
  - ## Which services are easy to place, which are more difficult
  - ## Which risk factors make placement more difficult
    - ### Can risk mitigation facilitate placement of service?

Variety of visualization tools can be used
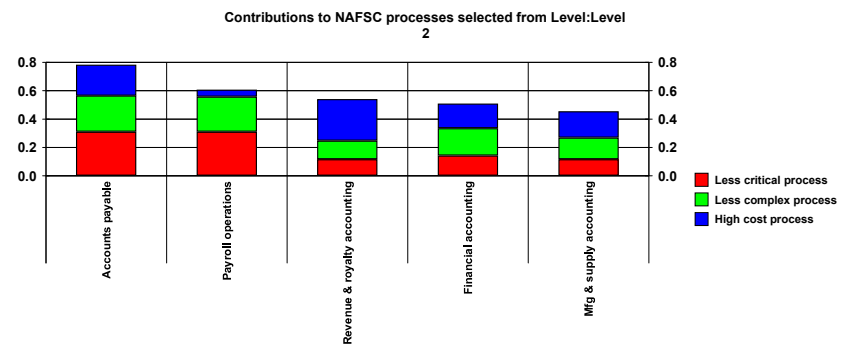
Conclusion – How fringe is this?

- **Many Decision Analysis elements**
  - Can incorporate with traditional DA analysis
- **Don't have to punt Decision Analysis if analytical work doesn't require tornado diagrams and S-curves**
  - Taylor the analytical approach to the decision
  - Still use DA framing, hierarchy, strategy, communication tools
  - Alternative ranking can use DA assessment techniques

- **Our Decision Makers feel that these methods add value**

- **Acknowledgements**

  I would like to thank my colleagues Larry Justice and Mike Young for their experience and examples of where Criterium ® DecisionPlus ® has been helpful for CT decision making