

25th anniversary
annual INCOSE
international symposium
Seattle, WA
July 13 - 16, 2015



Multi-Stakeholder Trade Space Exploration Using Group Decision Making Methodologies

Melissa Garber

What is this about?



Stakeholder Preferences on Trade-Offs



Interface to Externals



Training

Quality



Usability



Uncertainty

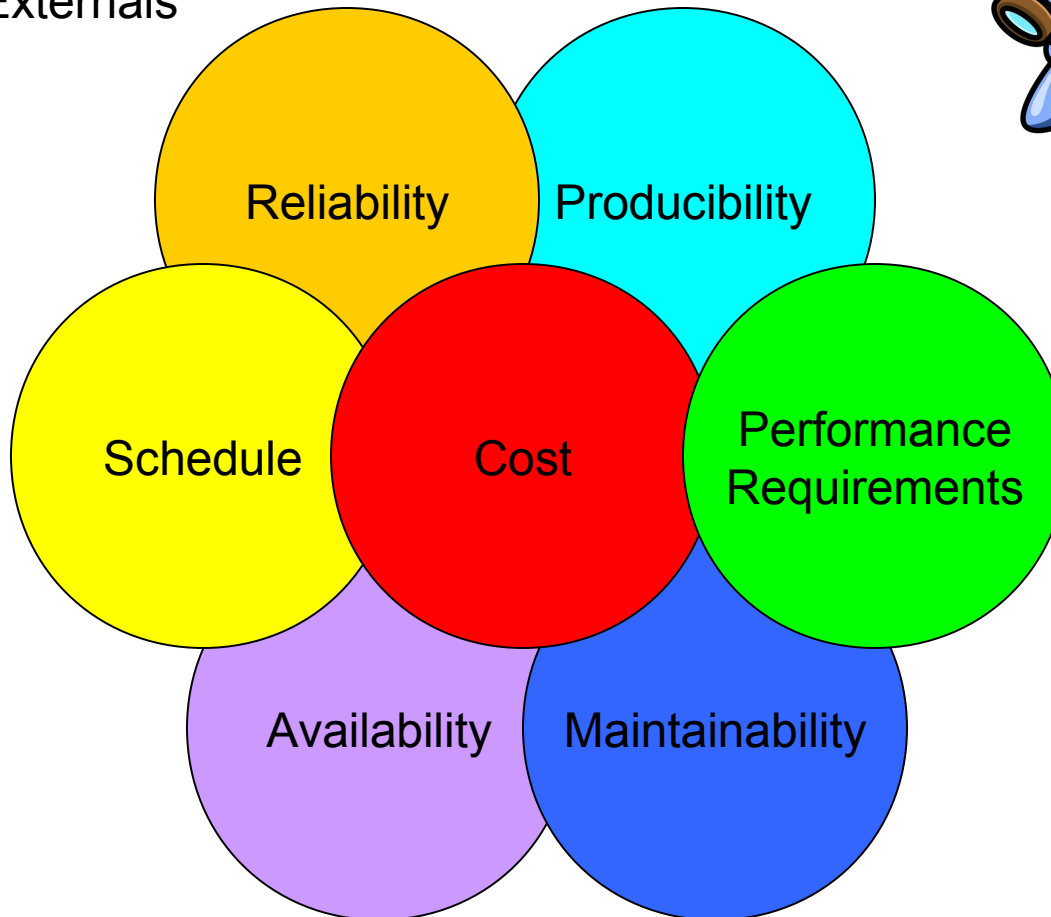


Disposability



Risk

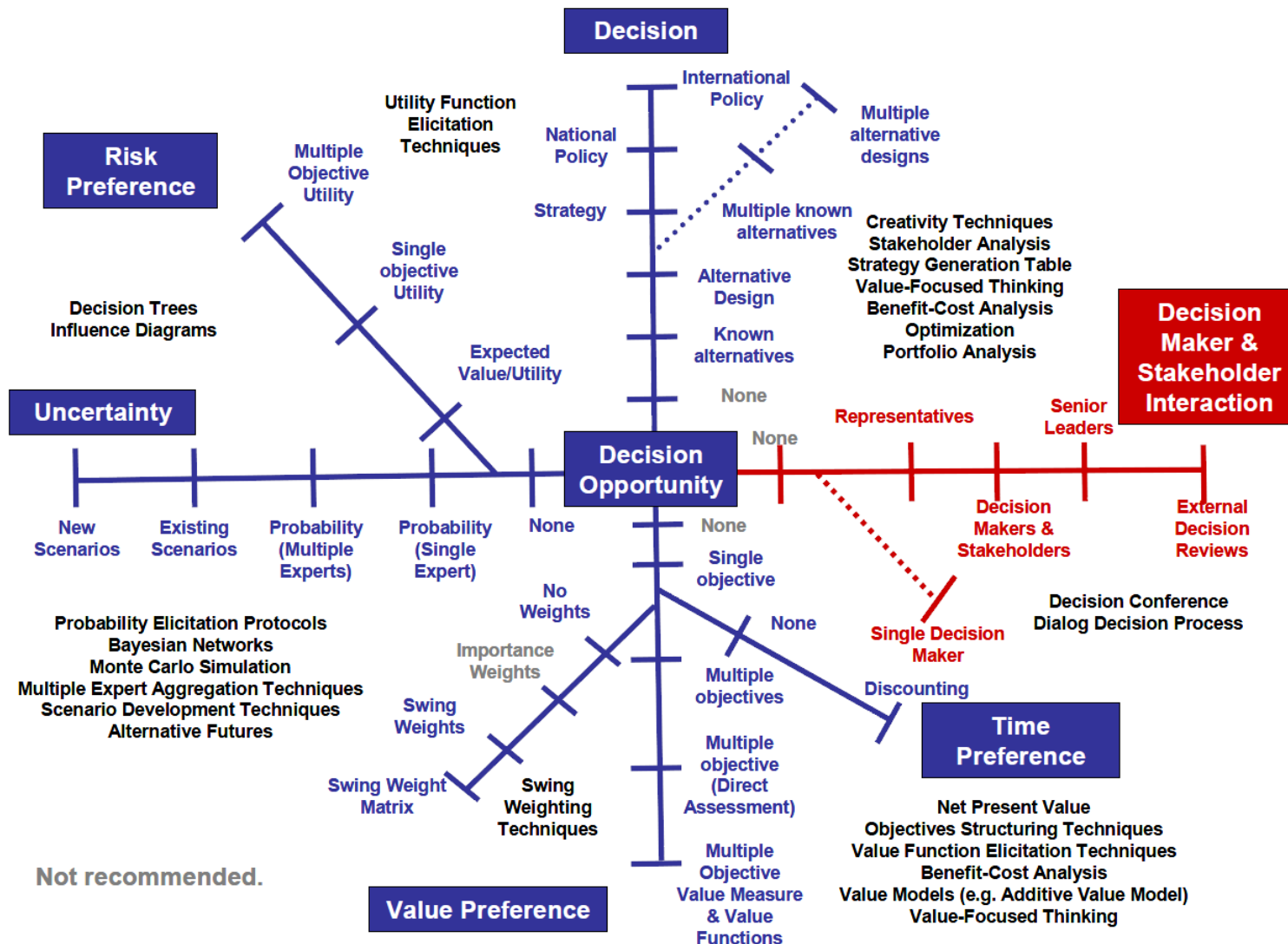
Integration



Throughout the Lifecycle

25th anniversary
annual INCOSE
international symposium
Seattle, WA
July 13 - 16, 2015

Why should we care?



Graphic and quote from
Decision Analysis in One Chart

by
Gregory S. Parnell

"Ineffective stakeholder and decision maker interaction is the primary source of failure of operations research studies to support decision makers"

What are our options?



- X Conduct trade studies without considering stakeholder preferences
- X Quiz the stakeholders on their preferences, then try to keep them in mind as the trade study is conducted
- ✓ Formalize a framework for injecting stakeholder preferences into trade study processes

How will this work?



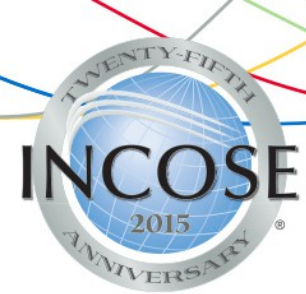
- Perform stakeholder analysis:
 - Identify individual stakeholders, relationships between stakeholders, and stakeholder types
 - Classify stakeholders based on access
- Execute each step in the trade study:
 - Define the step (e.g., select a set of alternatives or a set of criteria)
 - Select a decision making approach based on the decision to be made and the array of interested stakeholders
 - Select one or more group decision making (GDM) methodologies based on the decision making approach and the classes of the stakeholders involved
 - Quantify related stakeholder preferences
 - Execute the selected group decision making methodologies to determine the outcome of this trade study step

What has been done so far?



- Literature review
 - Trade study processes
 - Stakeholder theory
 - Group decision making processes
- Definition of the 3-way intersection between trade study processes, stakeholder theory, and group decision making processes:
 - 5 approaches to decision making
 - 4 classes of stakeholders
 - Example group decision making methodology mapping

5 approaches to decision making



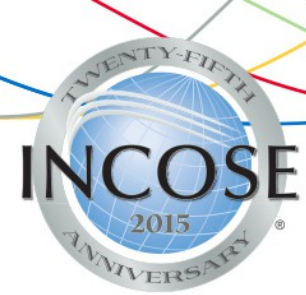
Type	Definition
Cooperation	A group must collectively select an alternative that best satisfies the group's objectives, and no individual has veto power.
Negotiation	Group members strive to satisfy their own objectives, rather than the group's objectives, and each individual has veto power.
Voting	A group must collectively select an alternative through a <u>prespecified rule</u> involving tabulation of individual votes, with no specific group action.
Consultation	An individual or group decision maker selects an alternative after taking preferences of individuals affected by the decision into account.
Singular	A single individual selects an alternative without input from teammates or Subject Matter Experts (<u>SMEs</u>).

4 classes of stakeholders



Class	Examples
Direct / Continuous	<ul style="list-style-type: none">❑ Trade Study Lead❑ Trade Study Team❑ SME❑ Program Manager
Direct / Sporadic	<ul style="list-style-type: none">❑ SME❑ Program Manager
Indirect / Sporadic	<ul style="list-style-type: none">❑ SME❑ Customer❑ Supplier
External	<ul style="list-style-type: none">❑ Indirect Customer❑ Supplier❑ Competitor

Example group decision making methodologies



Type	Definition
Simple Majority Rule	GDM methodology, used here exclusively for decisions between two alternatives, where each decision maker gets one vote and each vote is equally weighted
Keeney Utility Model	GDM methodology that combines the preferences of multiple decision makers on multiple alternatives
Social Deliberations	GDM methodology whereby multiple decision makers interact through discourse to reach common understanding and eventual agreement
Game Theory	GDM methodology that can serve as an algorithmic arbitration technique between multiple decision makers

Example group decision making methodology mapping

(Decision Making Approaches x Stakeholder Classes)



	Direct / Continuous	Direct / Sporadic	Indirect / Sporadic	External
Cooperation	<ul style="list-style-type: none"> □ Cooperative Social Deliberation □ Keeney Utility Model 	<ul style="list-style-type: none"> □ Cooperative Social Deliberation □ Keeney Utility Model 	<ul style="list-style-type: none"> □ Keeney Utility Model with Preference Elicitation Technique 	<ul style="list-style-type: none"> □ Keeney Utility Model with Stakeholder Preference Modeling
Negotiation	<ul style="list-style-type: none"> □ <u>Negotiative</u> Social Deliberation □ Game Theory 	<ul style="list-style-type: none"> □ <u>Negotiative</u> Social Deliberation □ Game Theory 	<ul style="list-style-type: none"> □ Game Theory with Stakeholder Preference Modeling 	<ul style="list-style-type: none"> □ Game Theory with Stakeholder Preference Modeling
Voting	<ul style="list-style-type: none"> □ Simple Majority Rule 	<ul style="list-style-type: none"> □ Simple Majority Rule 	<ul style="list-style-type: none"> □ Simple Majority Rule 	<ul style="list-style-type: none"> □ N/A¹
Consultation	<ul style="list-style-type: none"> □ Cooperative Social Deliberation 	<ul style="list-style-type: none"> □ Cooperative Social Deliberation 	<ul style="list-style-type: none"> □ N/A² 	<ul style="list-style-type: none"> □ N/A¹
Singular	<ul style="list-style-type: none"> □ N/A³ 	<ul style="list-style-type: none"> □ N/A³ 	<ul style="list-style-type: none"> □ N/A³ 	<ul style="list-style-type: none"> □ N/A³

Footnotes:

1. External stakeholders by definition cannot participate in Voting or Consultation, because their preferences are gathered, rather than solicited.
2. By definition, the preferences of Indirect / Sporadic stakeholders can only be solicited indirectly, by surveys for instance. Therefore, they cannot participate in Consultation.
3. Only the decision maker takes part in a Singular decision making approach, and by definition no stakeholders are considered and no GDM methodologies are used. This is included for completeness; many Singular trade studies are conducted.

What lies ahead?



- Full definition of the framework
 - Stakeholder identification, preference elicitation, and network mapping methodologies
 - Methodologies for system lifecycle and trade study process step mapping of stakeholders
 - Definition of artifacts for each step in the process
- Execution of the framework
- Validation of the framework