

Decision analysis tools for Security, Safety, and Sustainability of Ports and Harbors

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Illustrative Challenges

Identify four examples to consider throughout the decision analysis chapter:

- Example 1: Management of hazardous material at ports
- Example 2: Dredging of contaminated material
- Example 3: General terrorist attacks at ports
- Example 4: Specific terrorist attack: “dirty bomb” in a port

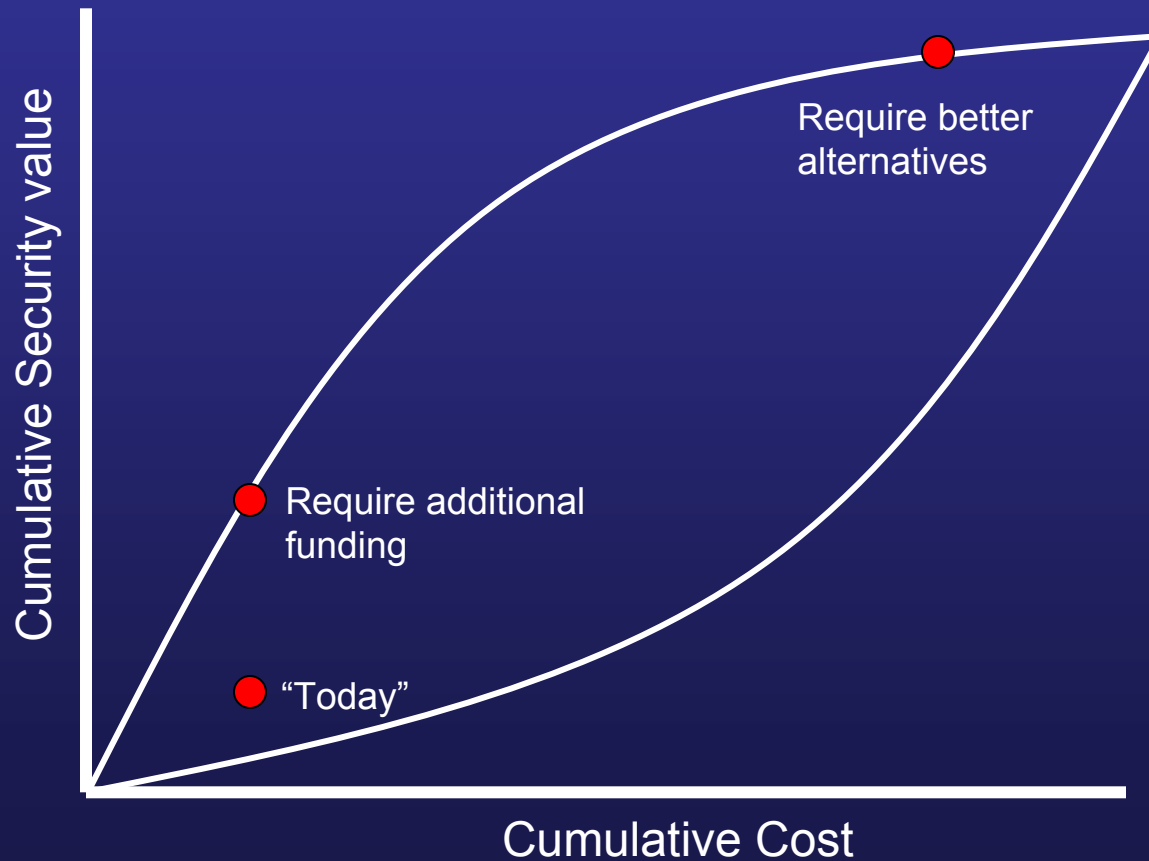
Challenges for industrial ports and harbors

- Support national economic trade
- Make a profit
- Involve international, national, local, and private stakeholders
- Assess all risks in port and harbor operations: Safety, Security, Health, and Sustainability (including environment)
 - Counter an intelligent, resourceful, adaptive adversaries
- Spend risk management funds wisely



Decision analysis has 3+ decades of successful applications in private and public sector.

Illustrative Cost-Benefit Analysis



Decision makers and Critical Stakeholders

Operational

- Port Operators
- Port Security
- Shipping Companies
- Port/Harbor employees
- Funders & Insurers
- Intermodal facilities
- Rail/Truck (ground transportation) Operators
- Fire Brigade/Emergency Services
- Coast Guard
- Civil defense
- Military

Regulatory

- State/Province and National Executive and Legislative Authorities
 - Department of Transport
 - Health & Safety Agencies
 - Environment Agencies
 - Railway regulators
 - Customs & Revenue Service
- Local Authorities
 - Port Authorities & Police
 - Nature Conservation Bodies

Others

- Citizenry
- Local Industry
- Professional and Consumer Organizations
- NGOs

Adapted from Preventing & Responding to Major Environmental Incidents in the UK: An Overview

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Fundamental Objectives

- Safety
- Public Health
- Security
- Sustainability
 - Social Issues
 - Environmental Protection
 - Economic Issues
- Political Concerns

Stakeholder/Objectives Matrix

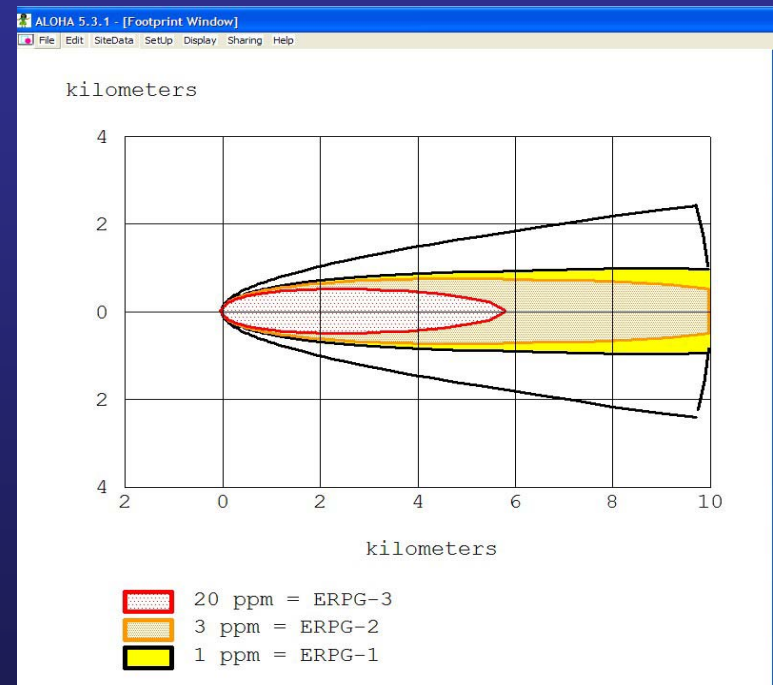
STAKEHOLDERS		FUNDAMENTAL OBJECTIVES						
		Safety	Health	Security	Social	Sustainability Environmental / Ecological	Economic	Political Concerns
Operational								
	Port Operators	X	X	X		X	X	
	Port Security			X				
	Shipping Companies						X	X
	Port/Harbor employees	X	X	X	X		X	
	Funders & Insurers	X	X	X		X	X	X
	Rail/Truck (ground transportation) Operators	2	2	2			1	
	Fire Brigade / Emergency Services	1	2			2		
	Coast Guard			1				
	Civil defense			1				
	Military			1		2		2
Regulatory State/Province and National Executive and Legislative Authorities								
	Department of Transport	2		1			1	
	Health & Safety Agencies	1	1					
	Environment Agencies					1		
	Railway regulators						1	
	Customs & Revenue						1	
Local Authorities								
	Port Authorities & Police			1				
	Nature Conservation					1		
Other Stakeholders								
	Citizenry	1	1		1		1	
	Local Industry						1	2
	Professional Organizations	1	1	1				
	Consumer Organizations / NGOs		1	1		1		2

Example Alternatives

<i>Scale of considerations</i>	<i>Philosophy for generating alternatives</i>	<i>Examples</i>	
		<i>Initial alternative</i>	<i>Generated alternative</i>
Policy	Look for wider policy option, utilize interdisciplinary approach	Marine transport of goods	Railway transport of goods
		Increase tax rate	Implement strict safety regulations
Plan	Look for different options within given sector of knowledge	Port reconstruction	Port relocation
Program	Look for different options within given sector of knowledge, be specific	Upgrading refinery facilities	Upgrading refinery and transportation facilities
Project	Consider details	Building a new pier	Different timing of the project

Motivation: A possible catastrophic scenario from *Example 3*

Two small watercraft enter the wet dock of the harbour undetected, where storage of chlorine (20 tons) is located. Major metropolitan area located 3 km from the chlorine storage in the harbour. Two boats increase probability of success; each boat transports 1 ton of explosive material, assumed to cause total loss of containment of the chlorine. Employees within a 200 m radius are dead or injured, and the installation within a 130 m radius are destroyed, even the alarm system with the sirens.



Problem Statements

Example 3: How do we protect ports and harbors from terrorist attacks?

- Describing
- Choosing
- Ranking
- Assigning

Problem Statements

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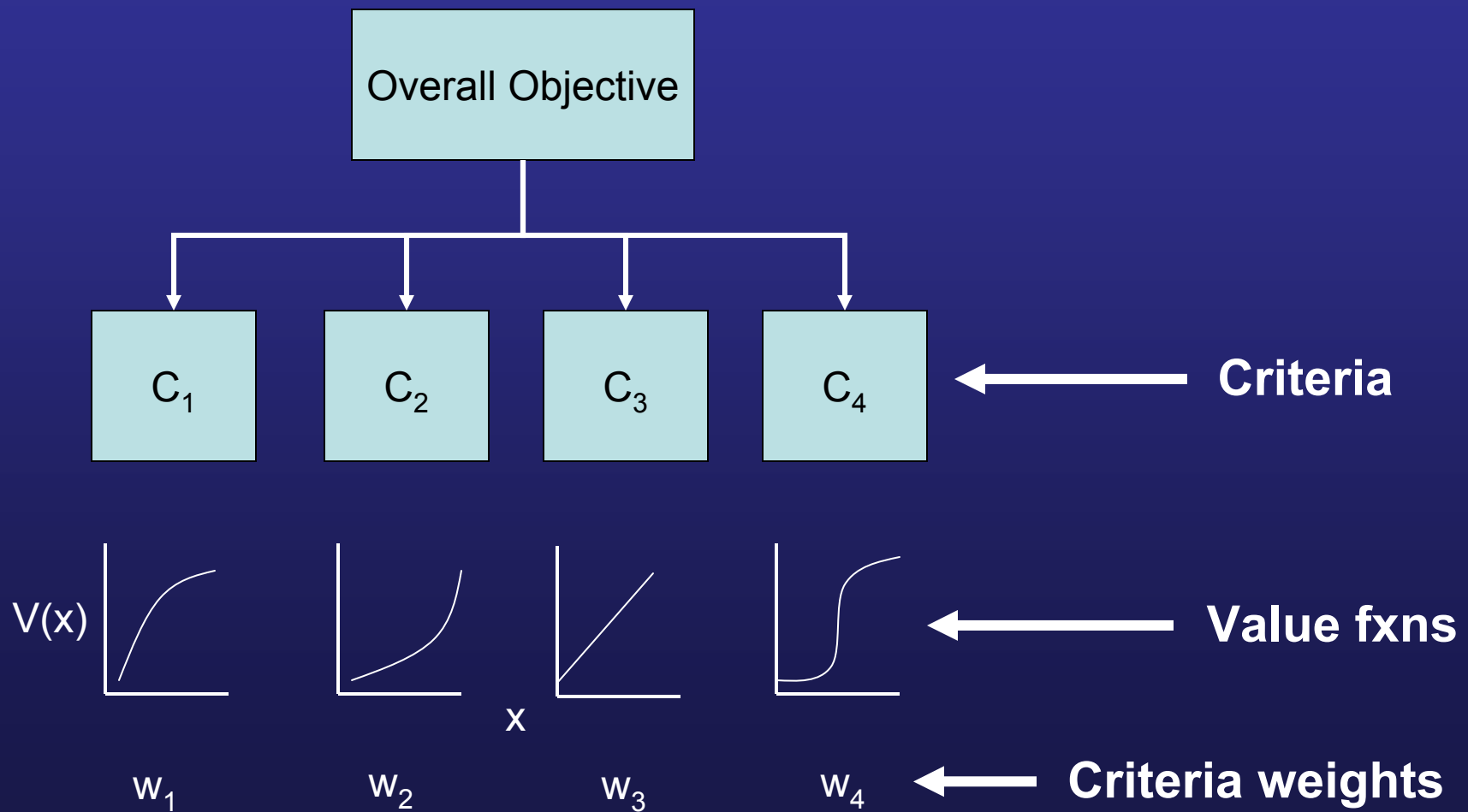
- Describing
 - Identify scenarios of chief concern
 - Identify current critical port vulnerabilities
 - Identify port security alternatives
 - Identify and assess consequences of security alternatives for each scenario
- Choosing
- Ranking
- Assigning

Problem Statements

Example 3: How do we protect ports and harbors from terrorist attacks?

- Describing
- Choosing
- Ranking
 - Rank security strategies according to a set of criteria
 - With and without *a priori* preferences
- Assigning

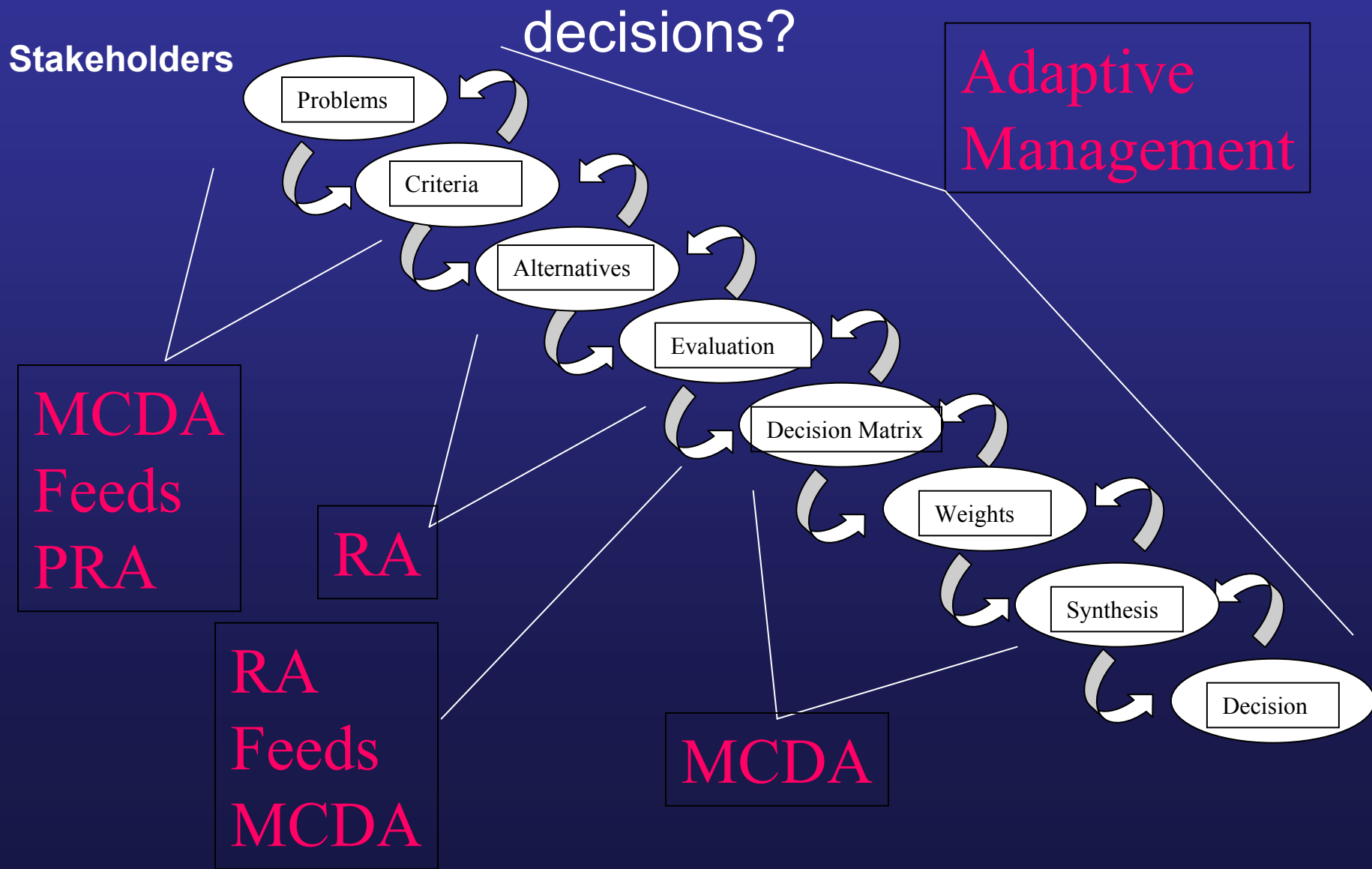
A Commonly-used MAVT Approach to Ranking Alternatives



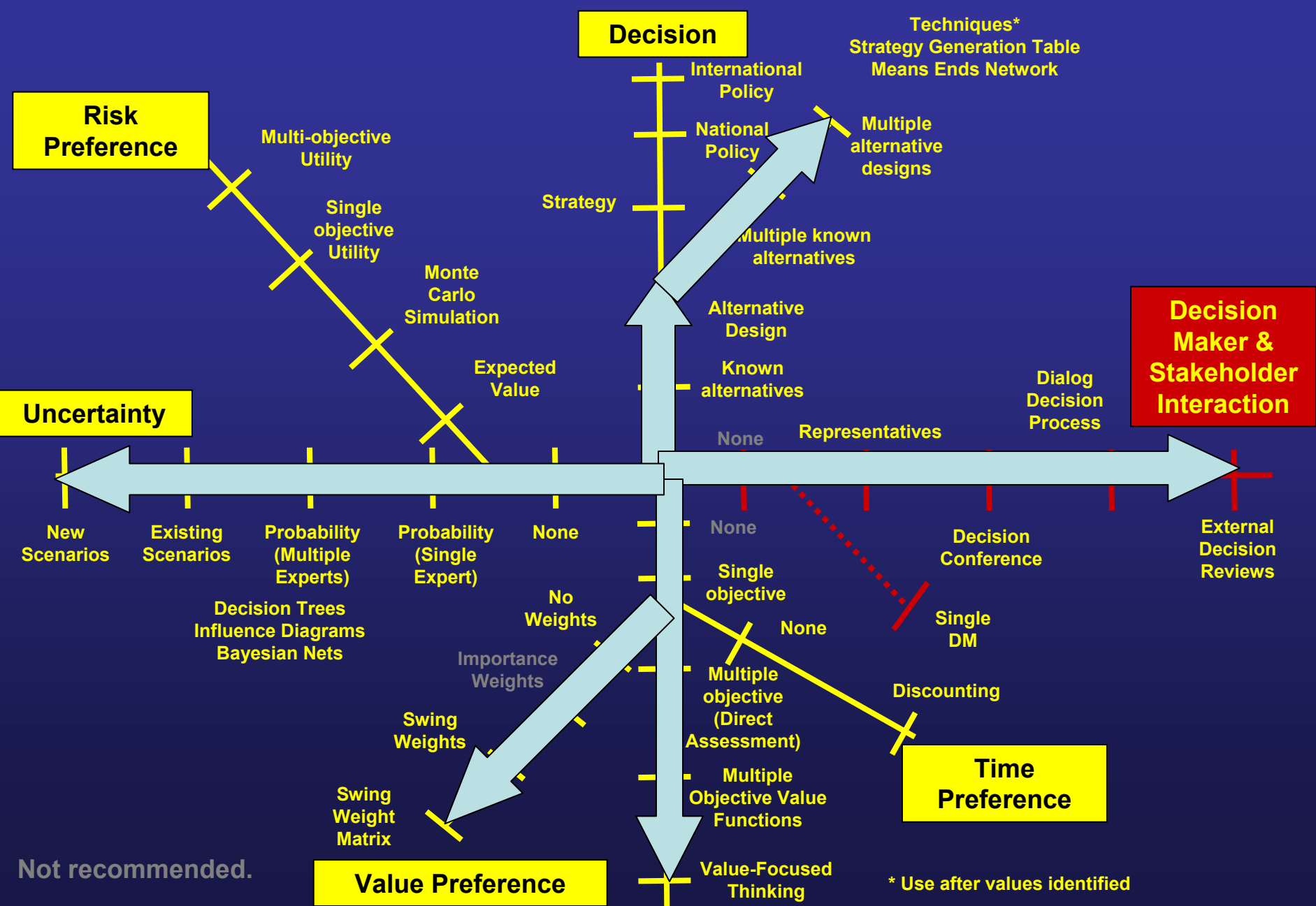
Risk Analysis

- Assessment
- Management
- Communication

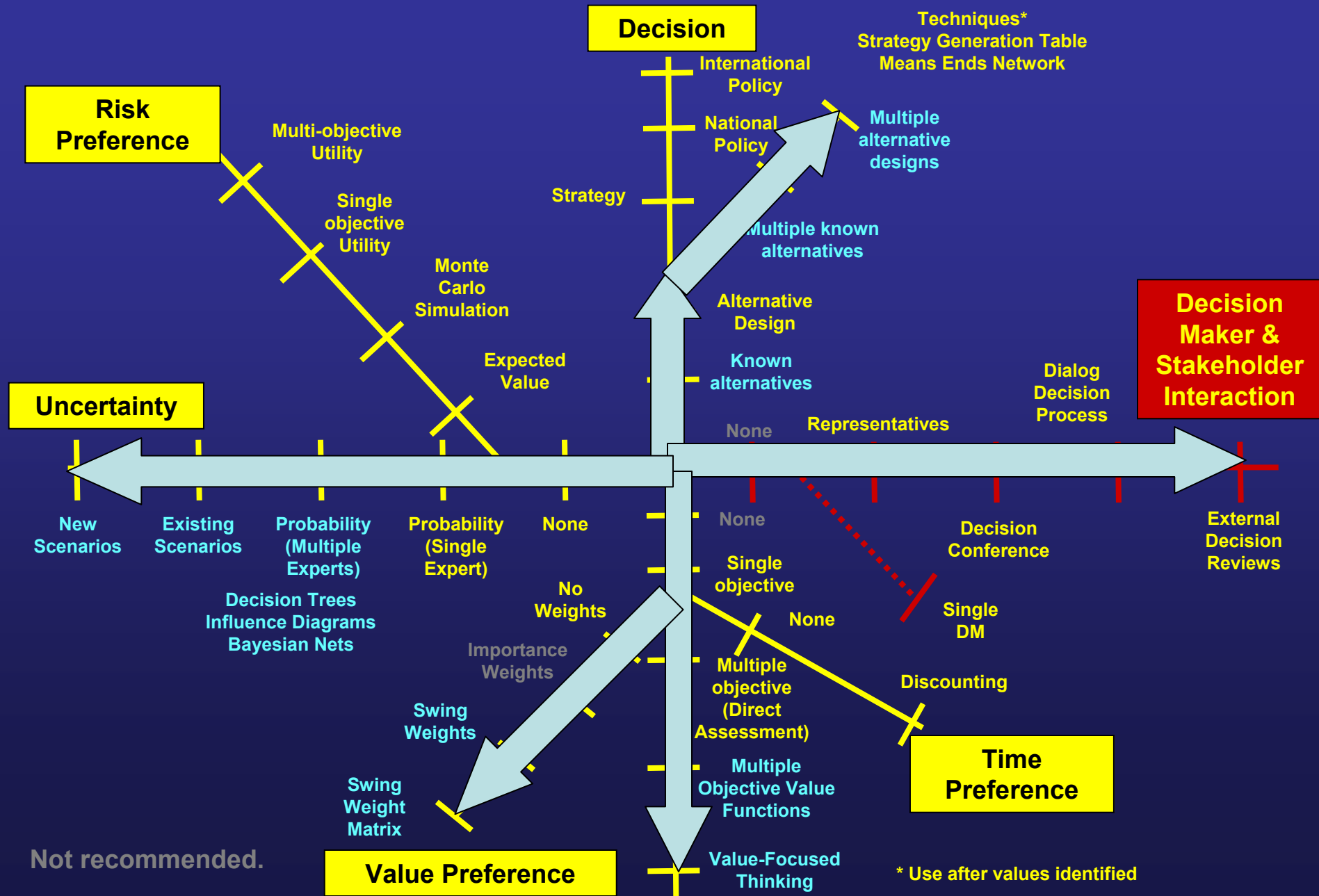
How, in theory or practice, can RA, MCDA and AM improve the quality and acceptability of decisions?



A comprehensive DA framework



A comprehensive DA framework



Conclusions and Perspectives

- Identification of stakeholders and their objectives is critical
- Scenario choices are critical to understanding uncertainties.
- Many alternatives exist (security strategies and others)
- Decision Analysis offers a systematic methodology for integrating conflicting objectives, considering uncertainties, and evaluating complex alternatives
- Integration of Risk Assessment and Decision Analysis
- Using MCDA techniques for risk management at ports and harbors
- Developed case studies and practical applications