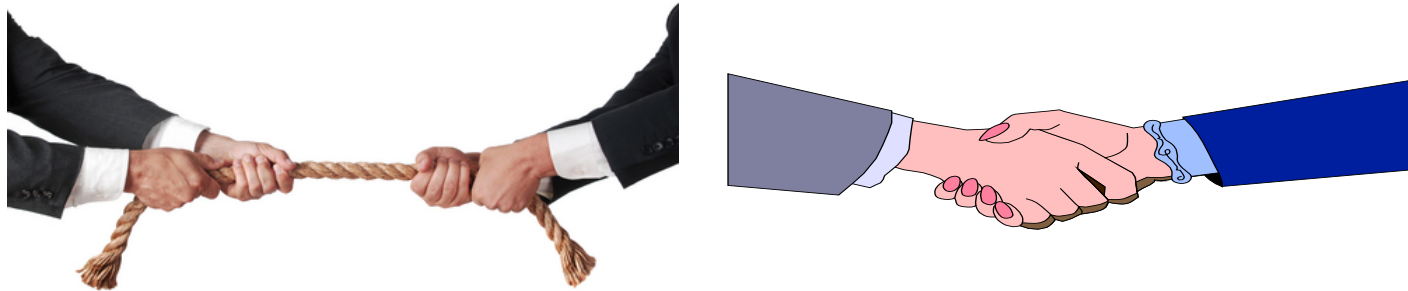


MULTI-OBJECTIVE MULTI-STAKEHOLDER DECISION ANALYSIS



L. Robin Keller

President

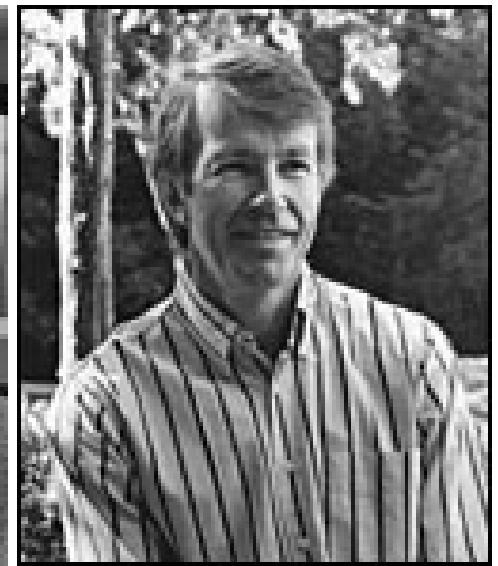
Institute for Operations Research & the Management Sciences

Professor

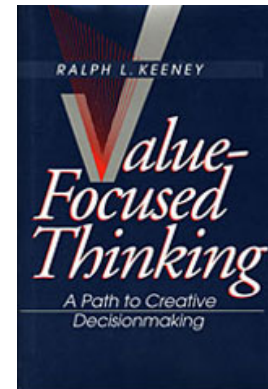
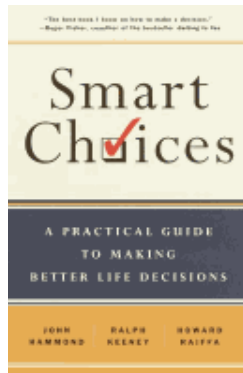
University of California, Irvine, USA



Decision Analysts
Howard Raiffa &
Ralph Keeney
advise us to make



Smart Choices & use **Value-Focused Thinking**



*Think about what we value
as expressed in our objectives*

Understanding the Objectives of Multiple Stakeholders can help...

-identify mutually agreeable alternatives



-foresee opposition to decisions



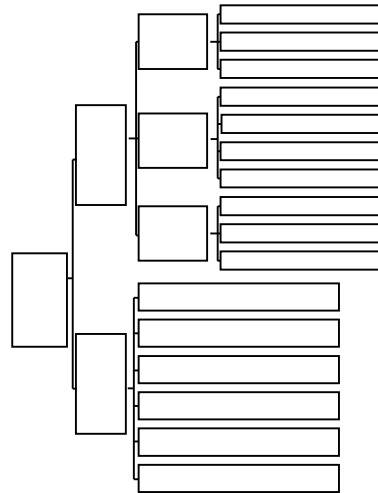
-design new & better alternatives



-understand the evolution of past decisions from multiple perspectives



Sometimes, one objectives hierarchy is suitable for a set of stakeholders



Differences across stakeholders in:

- tradeoffs between objectives
- evaluations of performance of alternatives on objectives

One Objectives Hierarchy

Evaluate plans for distribution of potassium iodide (KI) to protect against thyroid cancer, due to radioactive iodine exposure resulting from an incident at a U.S. nuclear power plant.

Young children or fetuses at most risk.



KI distribution alternatives:

- Predistribute to households, schools, hospitals, etc.
 - Via mail
 - Via voluntary pickup
- Stockpile at evacuation reception centers
- Do not predistribute



KI Distribution Decision Objectives

Minimize Radioactive Iodine Risk to Thyroid

Maximize KI Availability

Optimize Ability To Take KI On Time

Minimize Harm From Inappropriate KI Administration

Minimize Harm from Other Aspects of Incident

KI Procedures **Don't Impede Evacuation**

Avert Mortality/Morbidity From Radiation Or Accidents

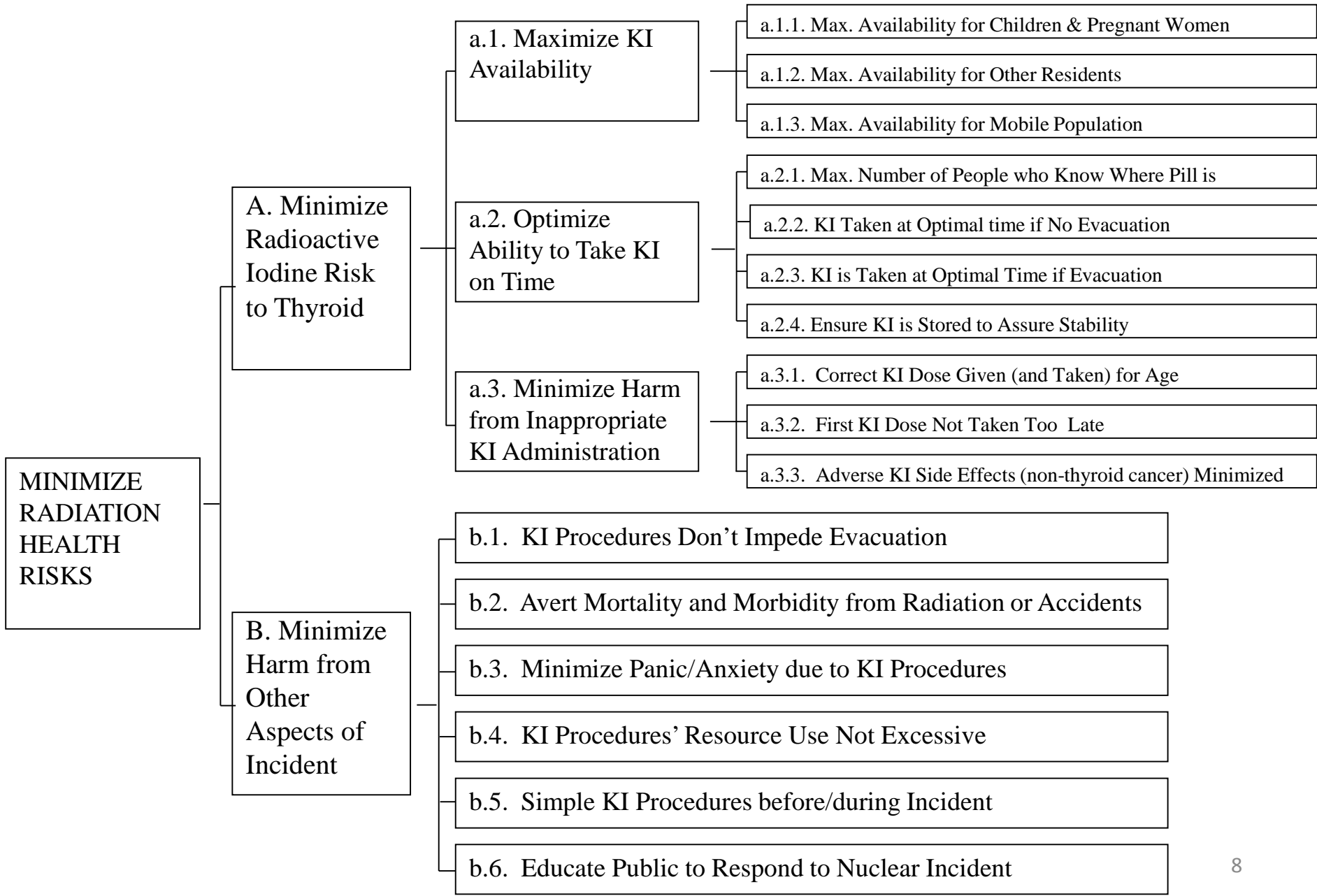
Minimize Panic/Anxiety Due To KI Procedures

KI Procedures' **Resource Use Not Excessive**

Simple KI Procedures Before/During Incident

Educate Public To Respond To Incidents

Objectives Hierarchy in Tree form





Different regions may differ in

- tradeoffs among objectives, or
- performance evaluations on objectives, ...
 - choosing different policy actions



Excel sheet with sliders allows dynamic sensitivity analysis on additive tradeoff weights

One Objectives Hierarchy: MERGER DECISION

ANALYSIS OF POTENTIAL MERGER OF
OPERATIONS RESEARCH SOCIETY OF AMERICA
(ORSA)
AND
THE INSTITUTE OF MANAGEMENT SCIENCES
(TIMS)

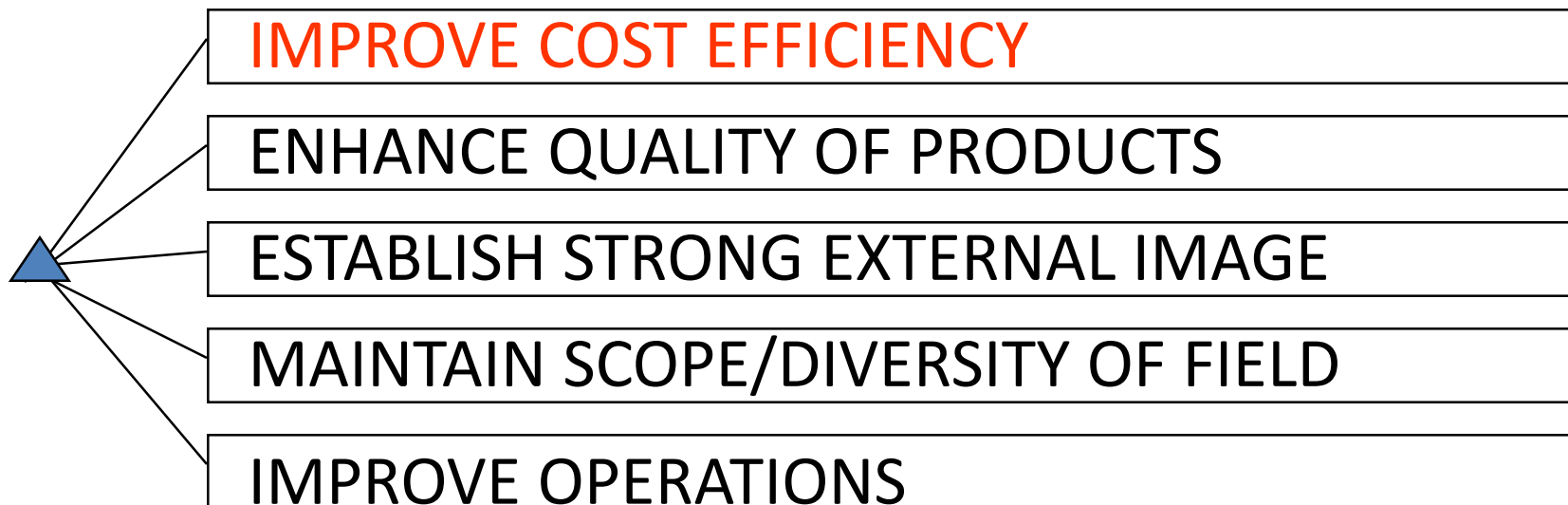


L. Robin Keller and Craig W. Kirkwood, "[The Founding of INFORMS: A Decision Analysis Perspective](http://faculty.sites.uci.edu/lrkeller/files/2011/06/The-Founding-of-Informs-Decision-Analysis.pdf)", *Operations Research*. 47(1), Jan.-Feb. 1999, 16-28. [faculty.sites.uci.edu/lrkeller/files/2011/06/The-Founding-of-Informs-Decision-Analysis.pdf]

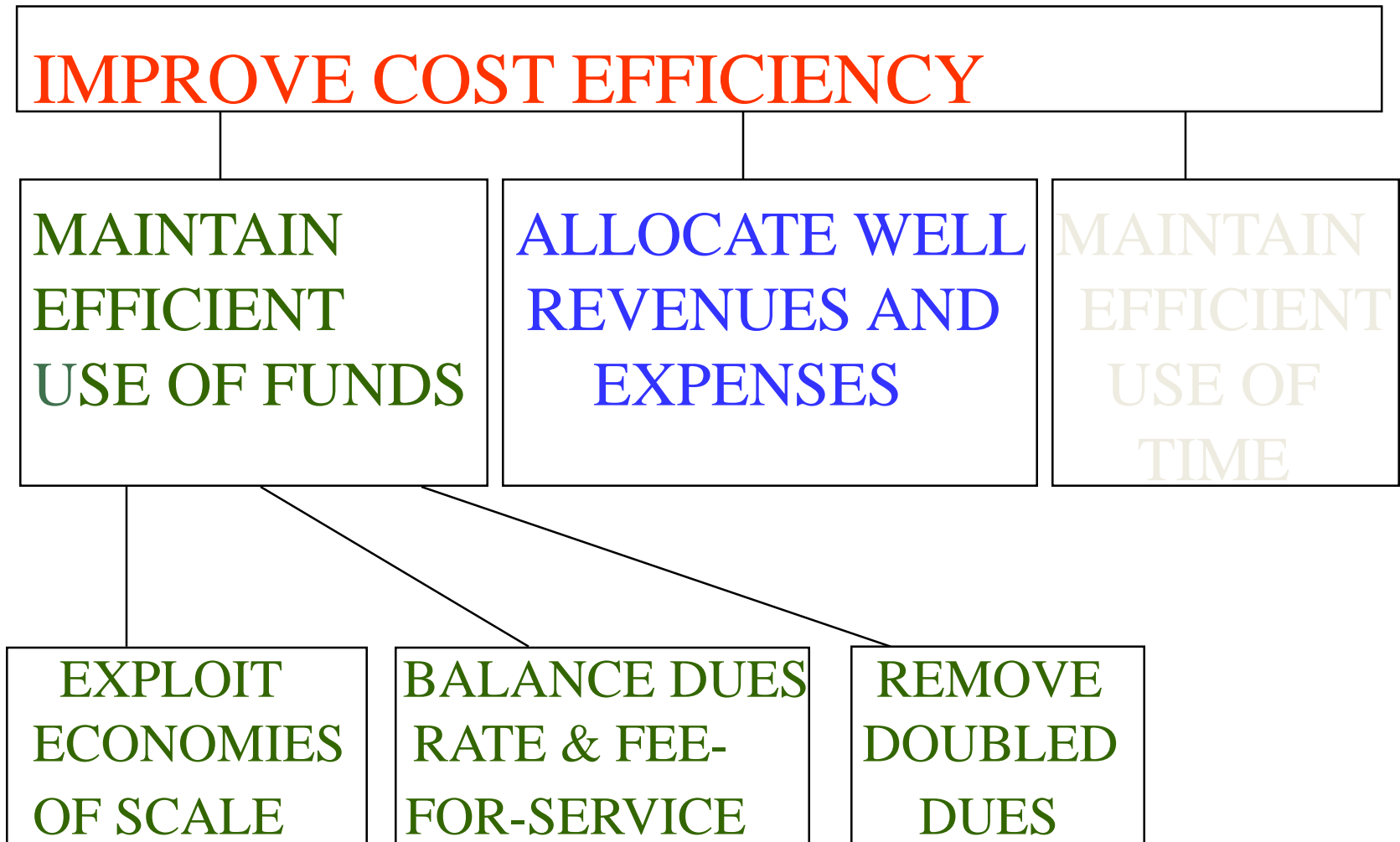
Powerpoint: <http://faculty.sites.uci.edu/lrkeller/classes/>

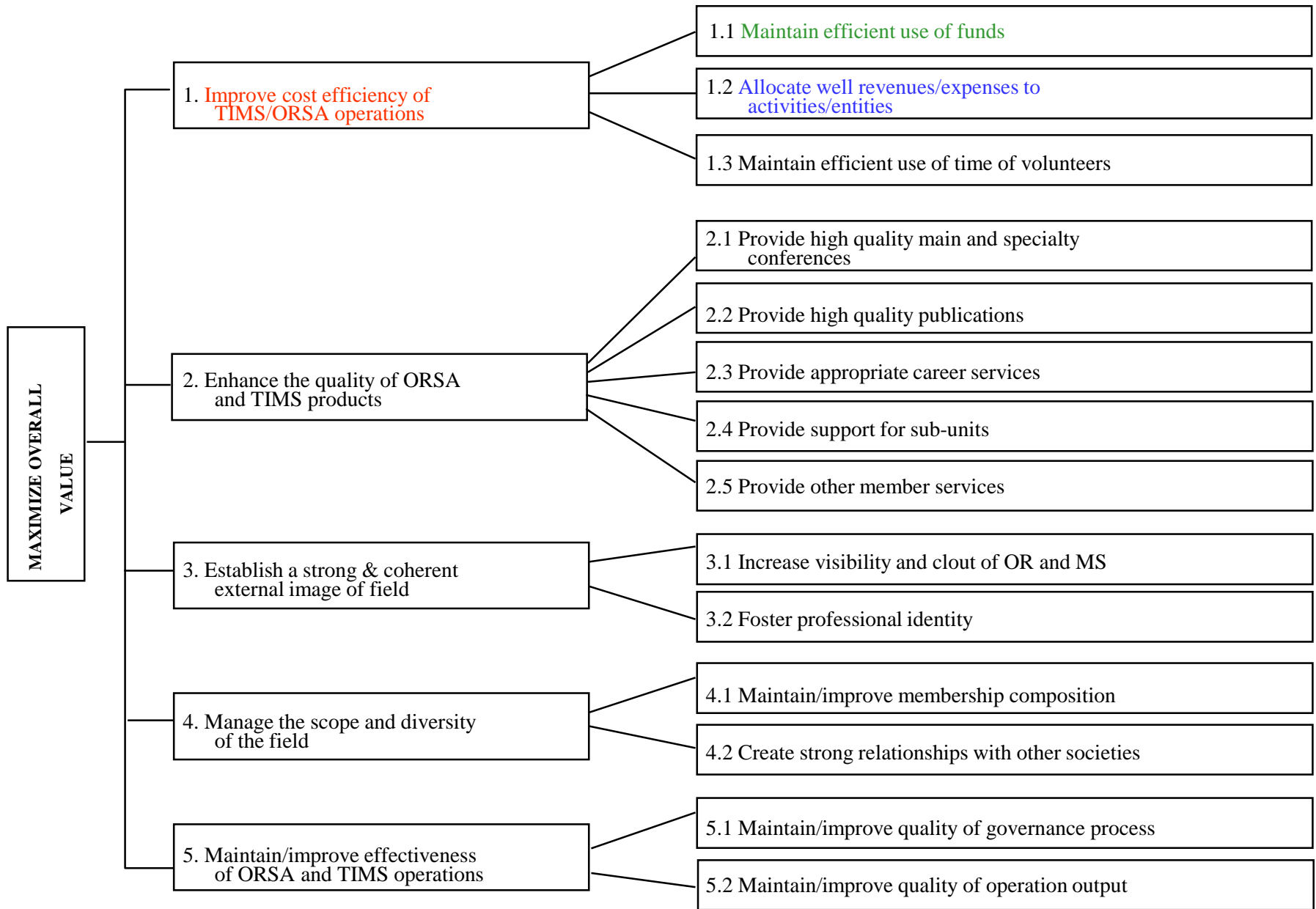
Elicited stakeholders' objectives & combined them into 1 hierarchy

- Top-level ORSA/TIMS MERGER OBJECTIVES



ADD BRANCHES TO MAIN CATEGORIES





MEMBERS VOTED TO MERGE IN
SEAMLESS MERGER

on JAN. 1ST, 1995

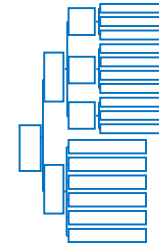
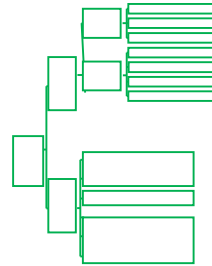
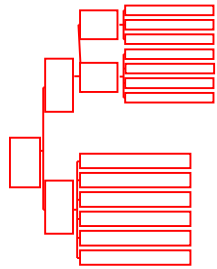
into

INSTITUTE FOR OPERATIONS RESEARCH AND
THE MANAGEMENT SCIENCES





In other cases,
an objectives hierarchy will be
constructed for each stakeholder



because their objectives are so
different that construction of separate
hierarchies better represents their
divergent perspectives.

Construct Separate Objectives Hierarchies, then Combine Together; August 1987 article in Energy Policy



Structuring West Germany's energy objectives

Ralph L. Keeney, Ortwin Renn and Detlof von Winterfeldt

For this article a comprehensive and politically legitimate list of criteria to evaluate energy systems was constructed from interviews with leading representatives of a broad spectrum of West German society. In the interviews, we probed the fundamental values of nine political and social organizations, including the Catholic and Lutheran Churches, the Federation of German Labour Unions, the Association of German Industries and the German Nature Society. A hierarchical representation of value criteria was logically structured for each group separately, and then aggregated into a combined 'value tree'. The result facilitates communication and constructive compromise, promotes the creation of policy options and helps evaluate future energy systems.

Keywords: West Germany's energy objectives; Value trees; Energy scenarios

Ralph L. Keeney is Professor of Systems Science and Detlof von Winterfeldt is Associate Professor of Systems Science with the Systems Science Department, Institute for Systems and Safety Management, University of Southern California, University Park, Los Angeles, CA 90089-0021, USA, and Ortwin Renn is an Associate Professor with the Center for Technology, Environment and Development

The government of West Germany faces difficult decisions about the development of energy policy for the next 50 years. Oil and gas have become expensive and unreliable sources of energy. Nuclear power has encountered stiff public opposition which has recently gained strength through the participation of the 'Greens' in the West German parliament. The cost escalation of the fast breeder and the high temperature reactor projects casts doubt on the economic viability of these advanced technologies. Coal, while abundant, is expensive and requires government subsidies. Furthermore, burning coal has been linked to acid rain and the gradual deterioration of German forests. Conservation and solar and wind technologies have limits in technical feasibility and in economic viability.¹

Recognizing these problems and the need for coordinated development of future energy systems, the West German parliament in 1978 created the Enquete Kommission 'Future nuclear energy policy'. This commission, which consists of seven members of parliament and eight scientific experts whose political affiliations were deliberately mixed, originally focused on nuclear power and decisions about development of the fast breeder reactor. The scope broadened when parliament charged the commission with studying alternative energy futures to 'present the future possibilities and necessities for decision-making, considering ecological, economic, societal, and safety aspects both in a national and international context, and to develop corresponding recommendations'.²

In response, the Enquete Kommission developed four alternative energy paths which represent very distinct economically and technically feasible developments of Germany's energy system during the coming

Bund der Deutschen Industrie (Association of German Industries)

Structuring West Germany's energy objectives

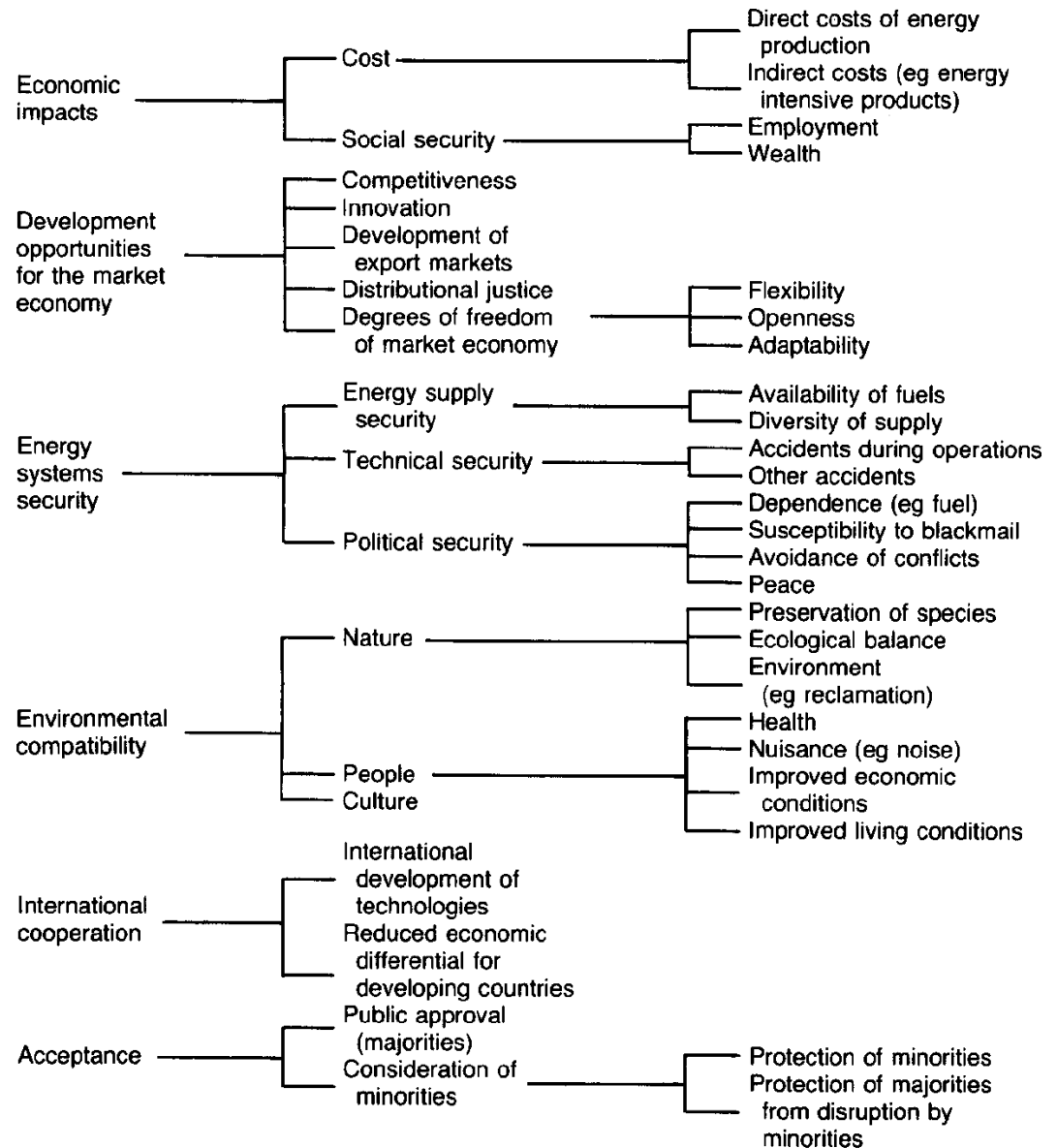


Figure 1. Value tree for the Association of German Industries (BDI).

Deutsche Katholische Kirche (German Catholic Church)

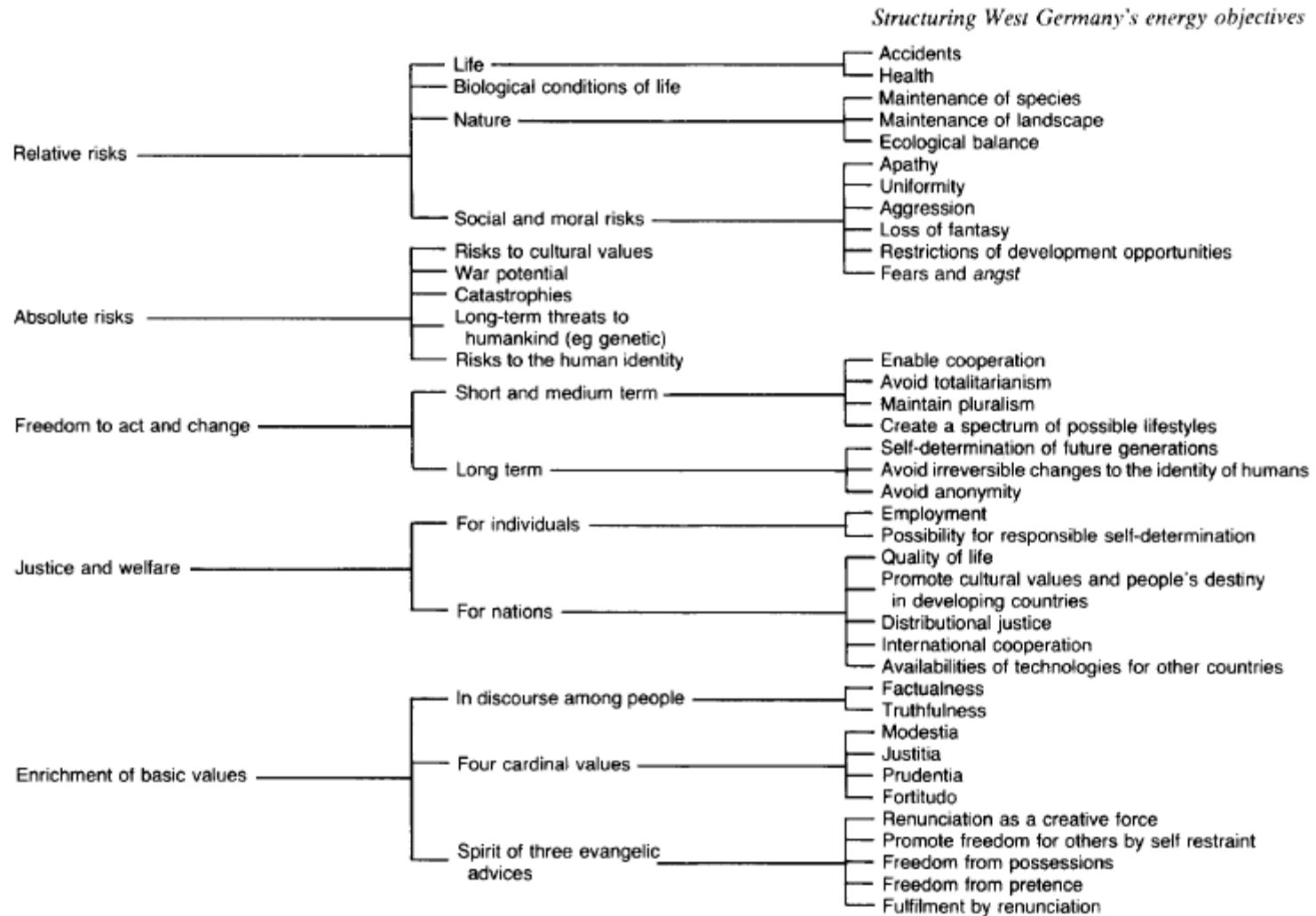


Figure 2. Value tree for the German Catholic Church (DKK).

Combined hierarchy

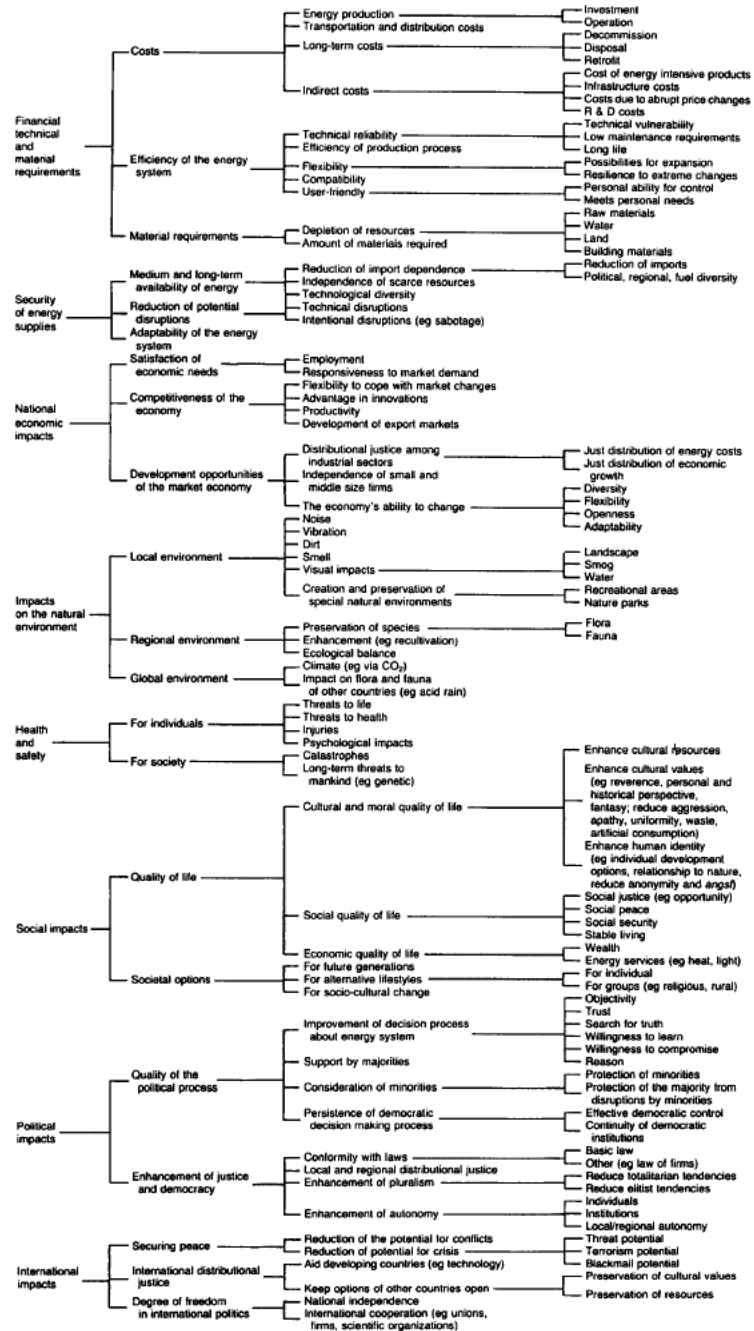
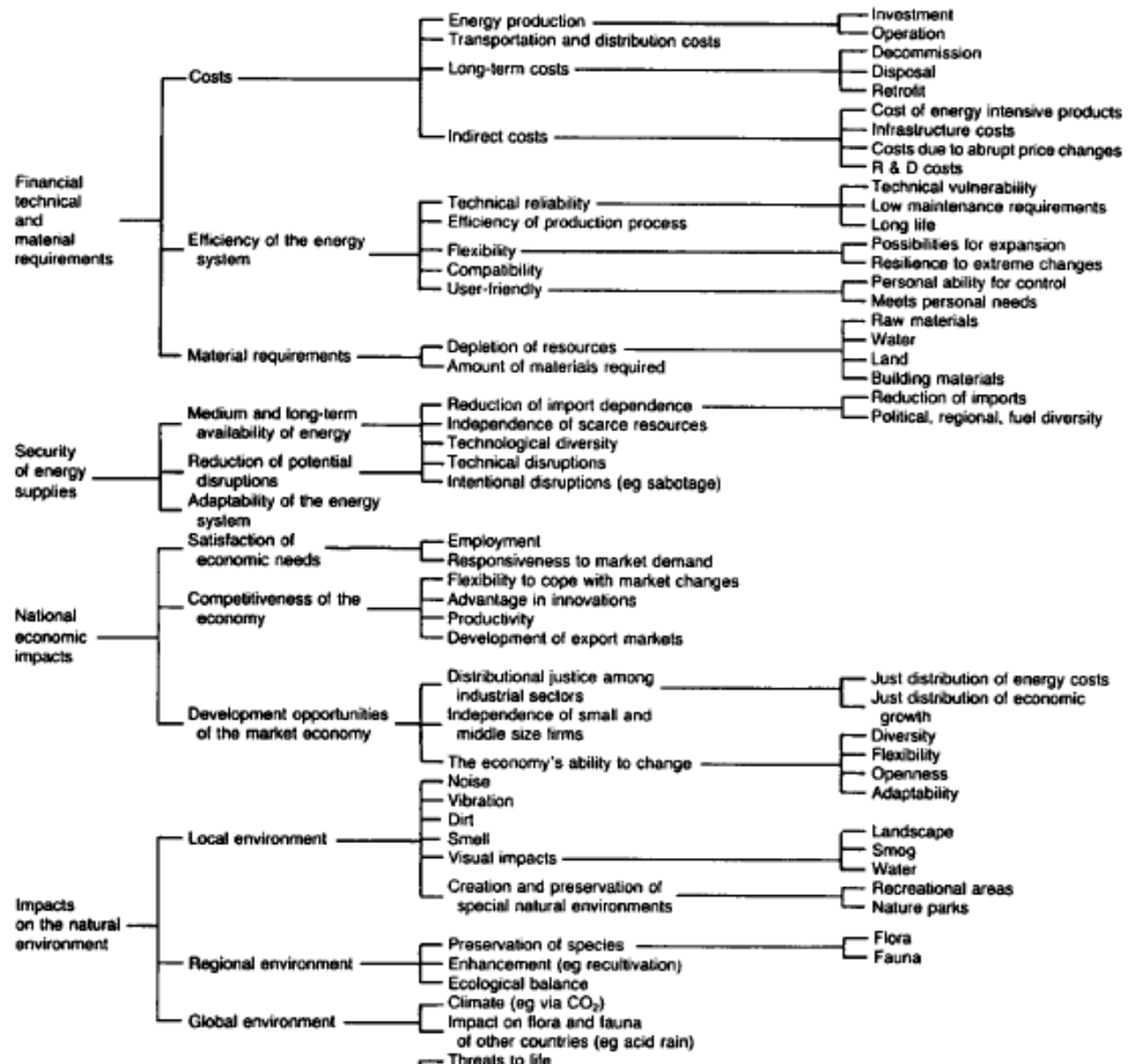


Figure 3. The combined value tree.

Combined hierarchy-Top half

Structuring West Germany's energy objectives



Combined hierarchy- Bottom half

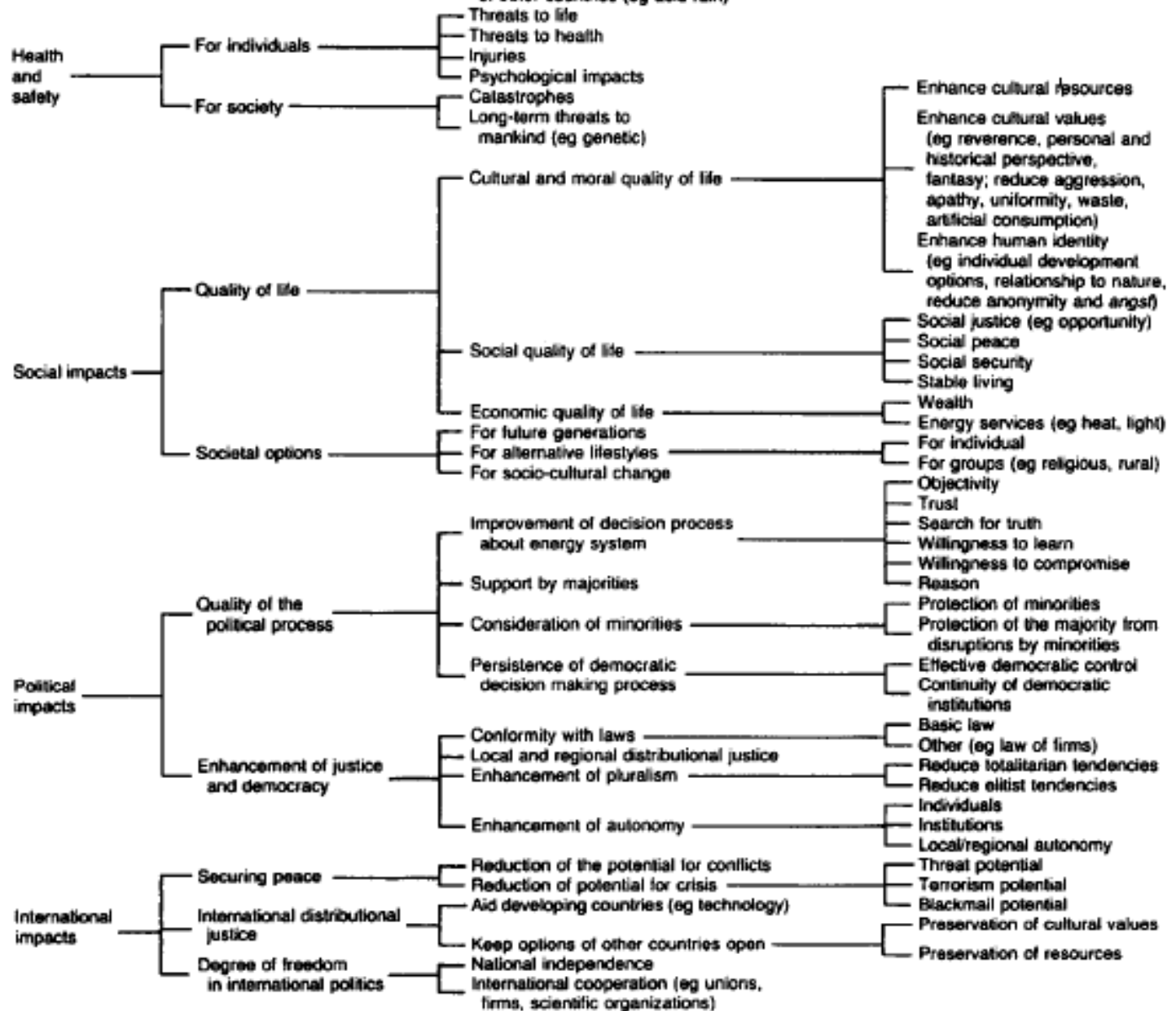


Figure 3. The combined value tree.

Multiple-Stakeholder Decision Making

The StarKist Tuna Fishing Decision

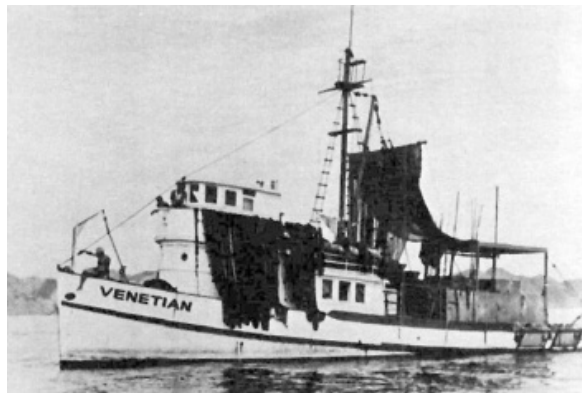


3 Major Stakeholders



Tuna Fishing Fleet San Diego, CA USA

<http://www.sandiegohistory.org/source/31fallimages/01va.jpg>



<http://www.earthisland.org/index.php/donate/>

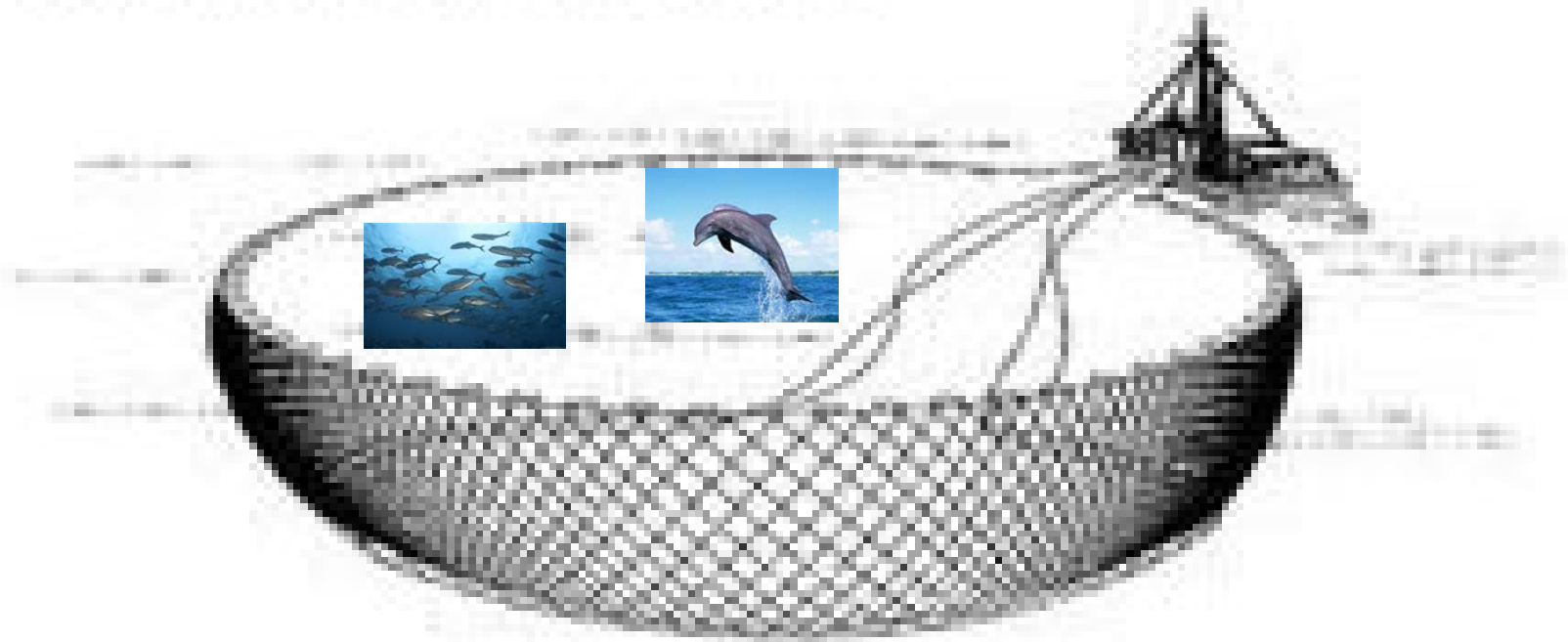
Monika I. Winn and L. Robin Keller, "A Modeling Methodology for Multi-Objective Multi-Stakeholder Decisions: Implications for Research", *Journal of Management Inquiry*, 10(2), June 2001, 166-181. [faculty.sites.uci.edu/lrkeller/files/2011/06/A-Modeling-Methodology-for-Multiobjective-Multistakeholder-Decisions-Implications-for-Research.pdf]
Much of this material is at <http://faculty.sites.uci.edu/lrkeller/classes/>



Problem: Boats' nets catch dolphins with tuna fish in Pacific ocean

image source <http://www.crownprince.com/nets-tuna.htm>

Purse Seine Net



DECISION ALTERNATIVES



Legal Quota

Maintain current practices and stay within legal limits

Limited Mortality

Step up efforts to reduce the number of dolphins killed

Zero-Mortality

No fishing associated with setting nets on dolphins

Decision Alternatives Rated for Fishing Fleet



Objectives Hierarchy	Decision Alternatives		
	Keep Status Quo	Reduce Dolphin Mortality	Go Dolphin Safe
MAINTAIN VIABLE BUSINESS	+	+	-
F1. Maintain Profitability			
F1.1. Maintain Lucrative Fishing Grounds	+	+	-
F1.2. Maintain Lucrative Fishing Methods	+	?	-
F1.3. Avoid Foreign Competition	+	?	-
F2. Maintain Livelihood			
F2.1. Maintain Fishing Grounds in East. Tropical Pacific	+	+	-
F2.2. Protect Large Investments in Boats	+	+	-
F2.3. Prevent Fishing Grounds from Depletion	?	+	-
F3. Maintain Quality of Life in Local Community			
F3.1. Protect Family-Owned Small Businesses & Heritage	+	+	-
F3.2. Maintain Positive Image in Community	?	+	+
F4. Protect Positive Image as Good Global Citizen			
F4.1. Legitimate Fishing Methods involving Dolphins	?	0	-
F4.2. Publicize Successes in Reducing Dolphin Mortality	0	+	+

+ favorable 0 neutral/balanced ? insufficient info. - unfavorable

Decision Alternatives Rated for Environmental Interest Groups



Objectives Hierarchy	Decision Alternatives		
	Keep Status Quo	Reduce Dolphin Mortality	Go Dolphin Safe
PROTECT MARINE MAMMALS	-	?	+
E1. Stop Killing of Dolphins			
E1.1. Protect Intelligent Large Marine Mammals	-	-	+
E1.2. Protect Species from Extinction	-	?	+
E2. Stop Cruelty to Dolphins			
E2.1. Prevent Herding by Helicopter & Detonations	-	?	+
E2.2. Prevent Harm from Entangling	-	-	+
E3. Generate Positive Public Image for Cause			
E3.1. Maximize Favorable Media Coverage	+	+	+
E3.2. Generate Positive Public Sentiment	+	+	+
E4. Improve Prestige of Special Interest Group			
E4.1. Increase Financial Support	?	?	+
E4.2. Gain Support from Celebrity Spokespersons	+	?	+

StarKist's "Crisis Mode" Objectives Hierarchy



Objectives Hierarchy	Decision Alternatives		
	Keep Status Quo	Reduce Dolphin Mortality	Go Dolphin Safe
ENSURE FIRM SURVIVAL	-	?	+
C1. Sustain Profitability			
C1.1. Maintain Favorable Industry Competitive Position	-	+	?
C1.1.1 Maintain Viable Cost Structure	+	+	?
C1.1.2 Maintain Revenue Stream	-	?	+
C1.2. Ensure Technological and Operational Feasibility	+	+	?
C2. Minimize Interference from Government Regulation			
C2.1. Minimize Regulation-Induced Cost Increases	-	+	+
C2.2. Minimize Constraints on Managerial Discretion	-	?	+
C3. Maintain Organizational Legitimacy			
C3.1. Maintain Image as "Good Corporate Citizen"	-	?	+
C3.1.1. Maximize Environmental Citizenship Image	-	?	+
C3.1.2. Maximize Social Citizenship Image	-	?	+
C3.2. Minimize Negative Perception at Critical Events	-	-	+
C3.2.1. Minimize Negative Environmental Perception	-	-	+
C3.2.2. Minimize Perception of Negative Social Impact	-	?	?

StarKist's (1991) Dolphin Safe Policy

"StarKist will not buy any tuna caught in association with dolphins in the Eastern Tropical Pacific."

Home Depot Case



Feng, T., L. R. Keller, X. Zheng. 2008. Modeling Multi-Objective Multi-Stakeholder Decisions: A Case-Exercise Approach. *INFORMS Transactions on Education* 8(3) 103-114, (<http://ite.pubs.informs.org/>, <http://pubsonline.informs.org/doi/abs/10.1287/ited.1080.0012> supplemental files: HomeDepotTeachingNote.pdf (for instructors), Excel file. Files also at <http://faculty.sites.uci.edu/lrkeller/classes/>



You can do it. We can help.™



Background

Building products company Home Depot proposed to open a retail building supply store in San Juan Capistrano, California USA

The new store would be on 15 acres in a strip of industrial land.

Home Depot owned two acres of this land.

The rest of the land was owned by the city, and would need to be bought.



You can do it. We can help.™



Background

- **The city would get \$9 Million if it sells Home Depot the 13 acres.**
- **Many were concerned that a “big box store” would destroy its historical small town feeling.**
- **Nearby residents also worry that a Home Depot would cause traffic jams, pollute the air, produce noise and block ocean breezes.**

Home Depot Case

Alternatives

Build Home Depot

Don't develop the land

Build a recreational vehicle park

Build specialty retail facilities

Stakeholders

City of San Juan Capistrano

Competing Local Small Businesses

Complementary Local Small Businesses

Home Depot

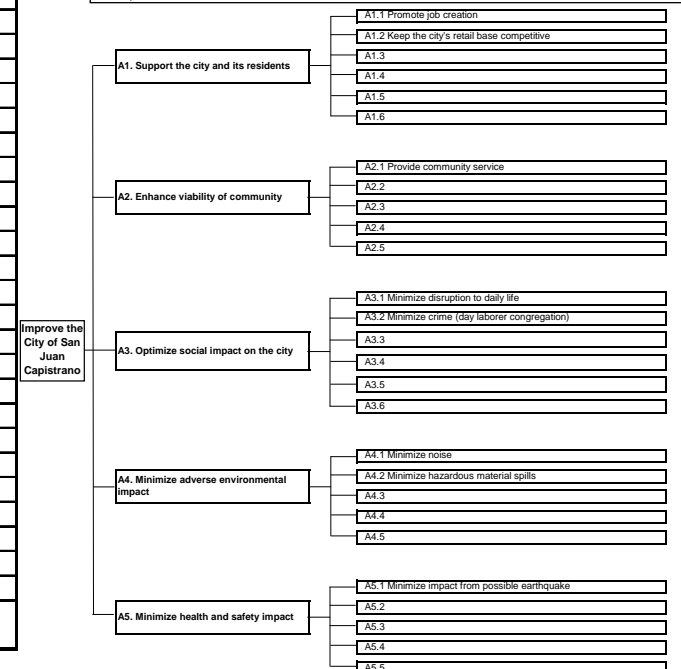
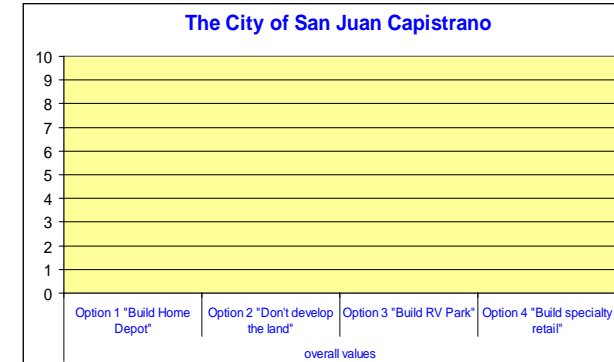
Nearby Residents

Other Area Residents

Spreadsheet Structure for Each Stakeholder

Decision Alternatives Rated for the City of San Juan Capistrano

OVERALL OBJECTIVES		Calculated Weights for Major Objectives	Calculated Normalized Weights	Slider	Fill in Raw Swing Weights (0-100)	Rating on Each Objective 0 - 10 = best			
						Option 1 "Build Home Depot"	Option 2 "Don't develop the land"	Option 3 "Build RV Park"	Option 4 "Build specialty retail"
A1. Support the city and its residents	A1.1 Promote job creation			◀ ▶					
	A1.2 Keep the city's retail base competitive			◀ ▶					
	A1.3			◀ ▶					
	A1.4			◀ ▶					
	A1.5			◀ ▶					
	A1.6			◀ ▶					
A2. Enhance viability of community	A2.1 Provide community service			◀ ▶					
	A2.2			◀ ▶					
	A2.3			◀ ▶					
	A2.4			◀ ▶					
	A2.5			◀ ▶					
A3. Optimize social impact on the city	A3.1 Minimize disruption to daily life			◀ ▶					
	A3.2 Minimize crime (day laborer congregation)			◀ ▶					
	A3.3			◀ ▶					
	A3.4			◀ ▶					
	A3.5			◀ ▶					
	A3.6			◀ ▶					
A4. Minimize adverse environmental impact	A4.1 Minimize noise			◀ ▶					
	A4.2 Minimize hazardous material spills			◀ ▶					
	A4.3			◀ ▶					
	A4.4			◀ ▶					
	A4.5			◀ ▶					
A5. Minimize health and safety impact	A5.1 Minimize impact from possible earthquake			◀ ▶					
	A5.2			◀ ▶					
	A5.3			◀ ▶					
	A5.4			◀ ▶					
	A5.5			◀ ▶					
OVERALL VALUE (SUMPRODUCT OF NORMALIZED WEIGHTS TIMES RATINGS)									



Identify group's objectives

						Rating on Each Objective 0 - 10 = best			
OVERALL OBJECTIVES		Calculated Weights for Major Objectives	Calculated Normalized Weights	Slider	Fill in Raw Swing Weights (0-100)	Option 1 "Build Home Depot"	Option 2 "Don't develop the land"	Option 3 "Build RV Park"	Option 4 "Build specialty retail"
A1. Support the city and its residents	A1.1 Promote job creation			◀ ▶					
	A1.2 Keep the city's retail base competitive			◀ ▶					
	A1.3 Promote convenience of shopping			◀ ▶					
	A1.4			◀ ▶					
	A1.5			◀ ▶					
	A1.6			◀ ▶					

Improve the City of San Juan Capistrano

A1. Support the city and its residents

A1.1 Promote job creation

A1.2 Keep the city's retail base competitive

A1.3 Promote convenience of shopping

A1.4

A1.5

A1.6

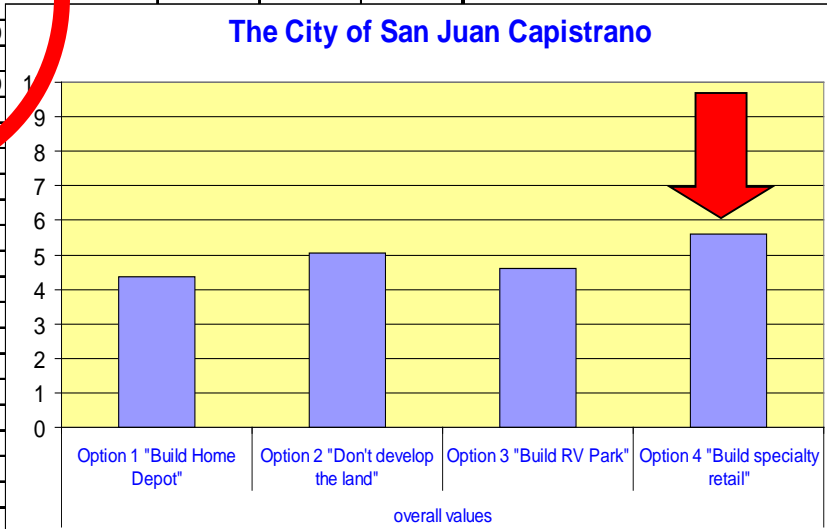
Complementary Local Small Businesses- Representative Hierarchy of Objectives

		Calculated Weights for Major Objectives	Calculated Normalized Weights	Slider	Fill in Raw Swing Weights (0-100)	Ratings on Each Objective 0 - 10 =best				
						Option 1 "Build Home Depot"	Option 2 "Don't develop the land"	Option 3 "Build RV Park"	Option 4 "Build specialty retail"	
OVERALL OBJECTIVES										
B1. Maintain market share	B1.1 Maintain prices competitive	0.35	0.10	<input type="text" value="0.10"/>	10	5	5	5	3	
	B1.2 Remain competitive by providing nearby convenience		0.25	<input type="text" value="0.25"/>	25	10	5	8	8	
	B1.3		0.00	<input type="text" value="0.00"/>						
B2. Minimize costs	B2.1 Minimize labor costs	0.65	0.35	<input type="text" value="0.35"/>	35	3	10	8	6	
	B2.2 Minimize Rent		0.25	<input type="text" value="0.25"/>	25	4	10	8	6	
	B2.3 Minimize Inventory Costs		0.05	<input type="text" value="0.05"/>	5	10	5	8	8	
	B2.4		0.00	<input type="text" value="0.00"/>						
OVERALL VALUE (SUMPRODUCT OF NORMALIZED WEIGHTS TIMES RATINGS)		1.00	1.00		100	5.55	8.00	7.70	6.30	

Moving Sliders on Weights Dynamically Changes Graph

Decision Alternatives Rated for the City of San Juan Capistrano

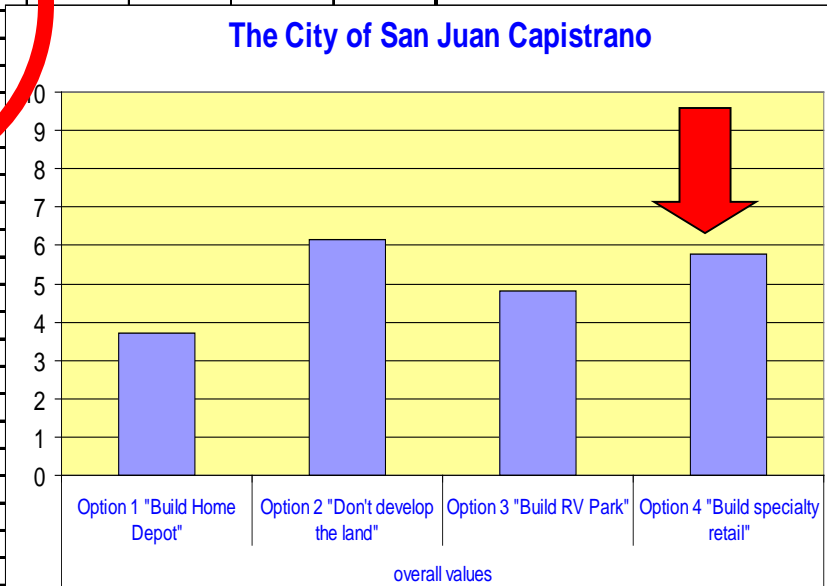
					Rating on Each Objective 0 - 10 = best				
OVERALL OBJECTIVES		Calculated Weights for Major Objectives	Calculated Normalized Weights	Slider	Fill in Raw Swing Weights (0-100)	Option 1 "Build Home Depot"	Option 2 "Don't develop the land"	Option 3 "Build RV Park"	Option 4 "Build specialty retail"
A1. Support the city and its residents	A1.1 Promote job creation	0.30	0.10	◀ ▶	100	10	0	2	5
	A1.2 Keep the city's retail base competitive		0.00	◀ ▶	100	10	0	0	5
	A1.3 Promote convenience of shopping		0.10	◀ ▶	100	10	0	0	5
	A1.4		0.00	◀ ▶					
	A1.5		0.00	◀ ▶					
	A1.6		0.00	◀ ▶					
A2. Enhance viability of community	A2.1 Provide community service	0.27	0.10	◀ ▶	100				
	A2.2 Maintain small town feel		0.02	◀ ▶	20				
	A2.3 Increase tax revenue		0.00	◀ ▶	100				
	A2.4 Min. impact on local businesses		0.00	◀ ▶	50				
	A2.5		0.00	◀ ▶					
A3. Optimize social impact on the city	A3.1 Minimize disruption to daily life	0.20	0.06	◀ ▶	83				
	A3.2 Minimize crime (day laborer congregation)		0.09	◀ ▶	90				
	A3.3 Min. traffic		0.05	◀ ▶	51				
	A3.4		0.00	◀ ▶					
	A3.5		0.00	◀ ▶					
	A3.6		0.00	◀ ▶					
A4. Minimize adverse environmental impact	A4.1 Minimize noise	0.19	0.05	◀ ▶	51				
	A4.2 Minimize hazardous material spills		0.07	◀ ▶	75				
	A4.3 Min. air pollution		0.07	◀ ▶	66				
	A4.4		0.00	◀ ▶					
	A4.5		0.00	◀ ▶					
A5. Minimize health and safety impact	A5.1 Minimize impact from possible earthquake	0.04	0.01	◀ ▶	15				
	A5.2 Min. traffic accidents		0.01	◀ ▶	15				
	A5.3 Min. impact on existing infrastructure		0.01	◀ ▶	15				
	A5.4		0.00	◀ ▶					
	A5.5		0.00	◀ ▶					
OVERALL VALUE (SUMPRODUCT OF NORMALIZED WEIGHTS TIMES RATINGS)		1.00	1.00		1011	4.35	5.05	4.59	5.59



Moving Sliders on Weights Dynamically Changes Graph

Decision Alternatives Rated for the City of San Juan Capistrano

					Rating on Each Objective 0 - 10 = best				
OVERALL OBJECTIVES		Calculated Weights for Major Objectives	Calculated Normalized Weights	Slider	Fill in Raw Swing Weights (0-100)	Option 1 "Build Home Depot"	Option 2 "Don't develop the land"	Option 3 "Build RV Park"	Option 4 "Build specialty retail"
A1. Support the city and its residents	A1.1 Promote job creation	0.26	0.11		91	10	0	2	5
	A1.2 Keep the city's retail base competitive		0.12		100	10	0	0	5
	A1.3 Promote convenience of shopping		0.03		25	10	0	0	5
	A1.4		0.0						
	A1.5		0.0						
	A1.6		0.0						
A2. Enhance viability of community	A2.1 Provide community service	0.21	0.0		20				
	A2.2 Maintain small town feel		0.02		20				
	A2.3 Increase tax revenue		0.10		84				
	A2.4 Min. impact on local businesses		0.06		50				
	A2.5		0.00						
A3. Optimize social impact on the city	A3.1 Minimize disruption to daily life	0.25	0.08		63				
	A3.2 Minimize crime (day laborer congregation)		0.11		90				
	A3.3 Min. traffic		0.06		51				
	A3.4		0.00						
	A3.5		0.00						
	A3.6		0.00						
A4. Minimize adverse environmental impact	A4.1 Minimize noise	0.23	0.06		51				
	A4.2 Minimize hazardous material spills		0.09		75				
	A4.3 Min. air pollution		0.08		66				
	A4.4		0.00						
	A4.5		0.00						
A5. Minimize health and safety impact	A5.1 Minimize impact from possible earthquake	0.05	0.02		15				
	A5.2 Min. traffic accidents		0.02		15				
	A5.3 Min. impact on existing infrastructure		0.02		15				
	A5.4		0.00						
	A5.5		0.00						
OVERALL VALUE (SUMPRODUCT OF NORMALIZED WEIGHTS TIMES RATINGS)		1.00	1.00		831	3.71	6.15	4.80	5.78



What do you think: Yes or No?



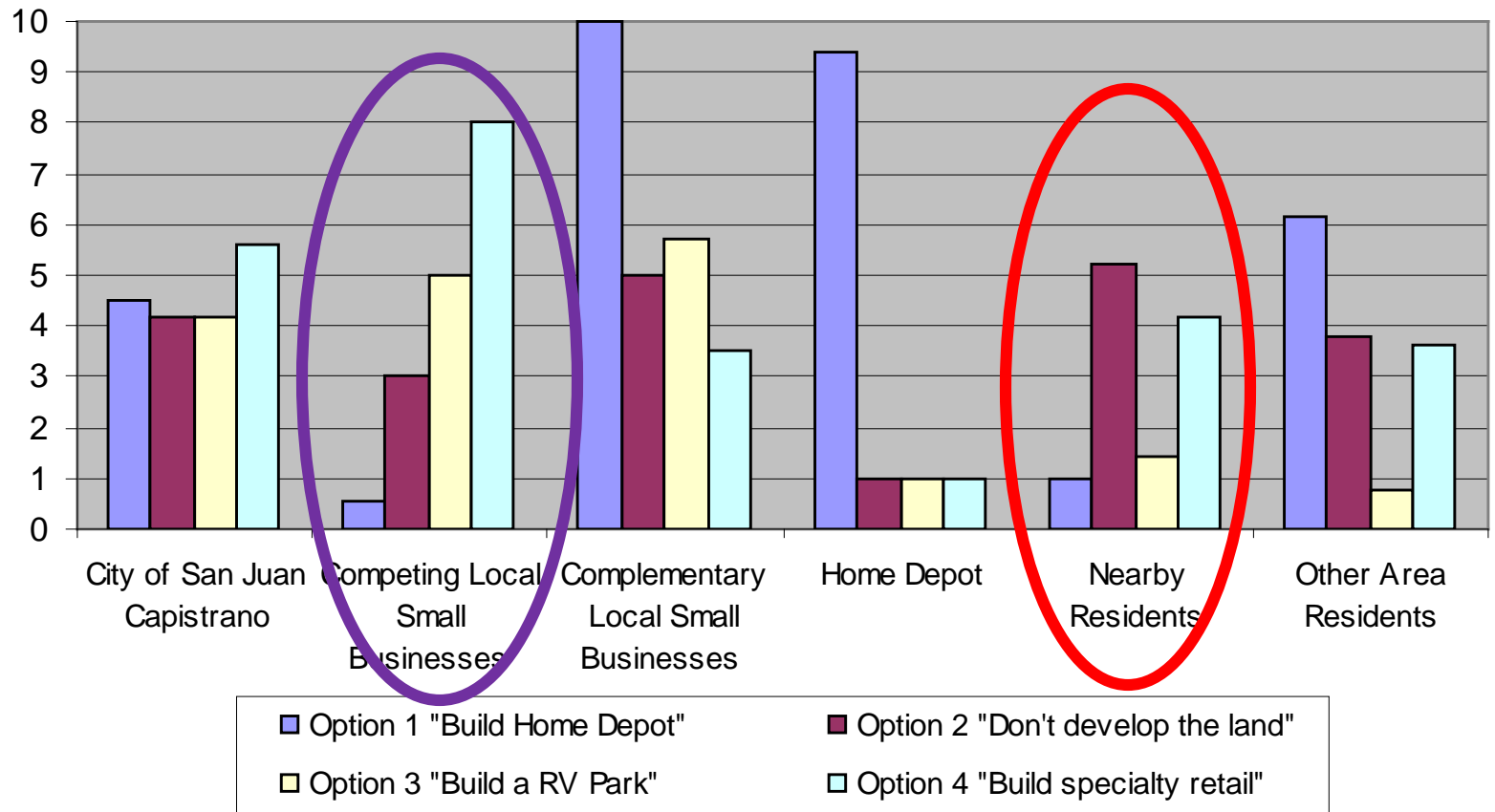
(City voters voted on this issue in November 2002.)

Example Home Depot Case Perspectives

	Overall Values			
	Option 1 Build Home Depot	Option 2 Don't develop the land	Option 3 Build RV Park	Option 4 Build specialty retail
City of San Juan Capistrano	4.5	4.2	4.2	5.6
Competing Local Small Businesses	0.6	3.0	5.0	8.0
Complementary Local Small Businesses	10.0	5.0	5.7	3.5
Home Depot	9.4	1.0	1.0	1.0
Nearby Residents	1.0	5.2	1.4	4.2
Other Area Residents	6.2	3.8	0.8	3.6

Each Stakeholder's View of Different Alternatives

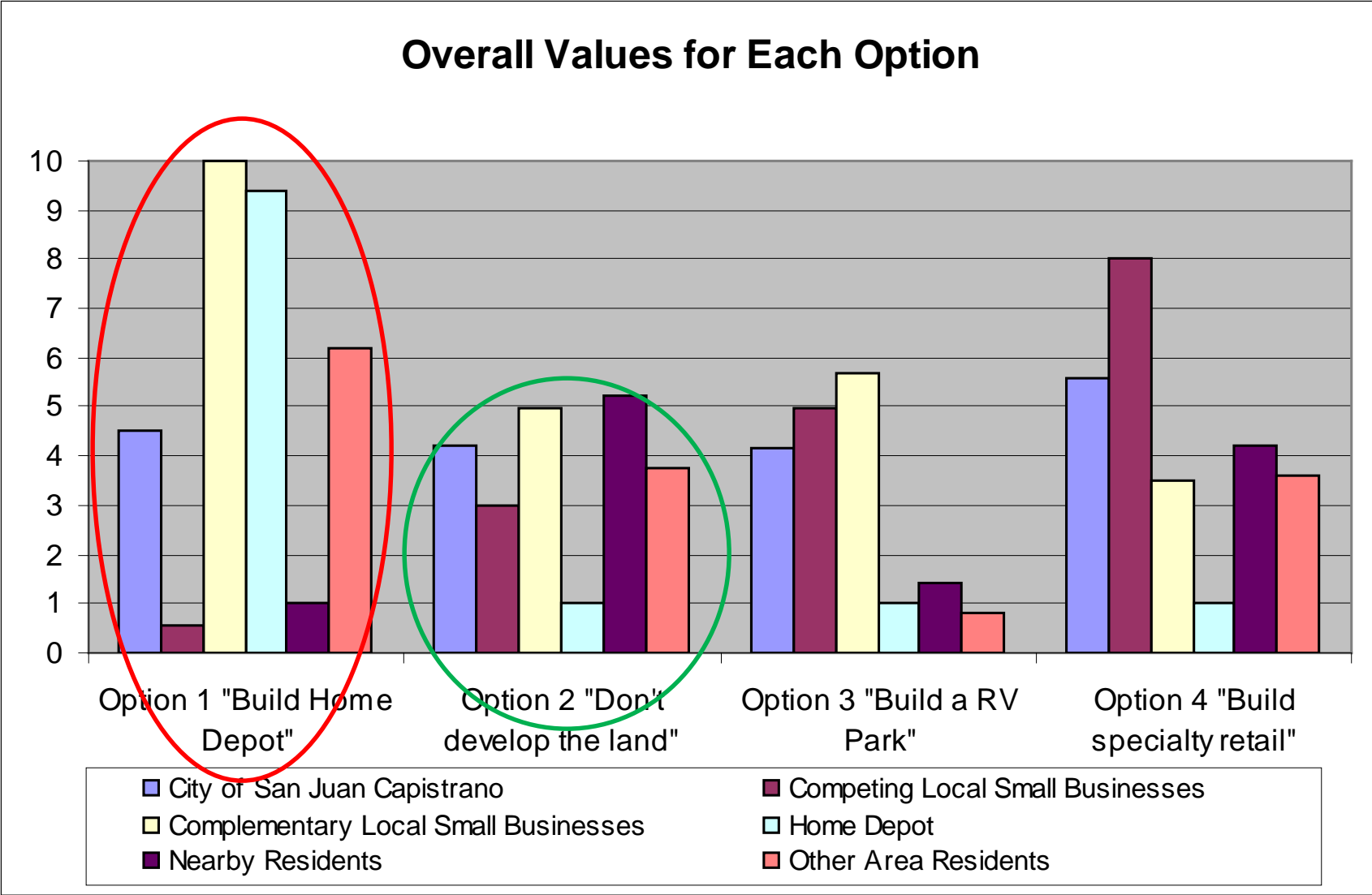
Overall Values for Each Stakeholder





Can examine how fair an alternative is from the perspective of each stakeholder, based on their overall value for the alternative

Each Alternative from Different Stakeholders' Viewpoints





Voters voted NO
There is no Home Depot in the city

So far, we have modeled decisions under certainty, with no probabilistic states of nature.

Different stakeholders often disagree about the riskiness of new ventures and technologies.

Decision trees with decision nodes and chance nodes can be constructed for each stakeholder.

Stakeholders may agree or disagree on different components (probabilities of outcomes, alternative actions, utility of outcomes, etc.)

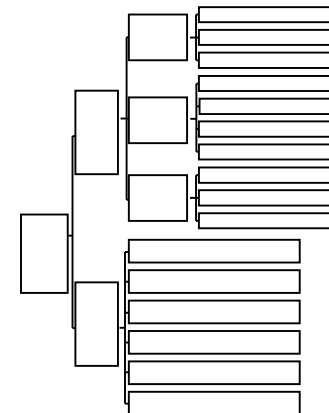
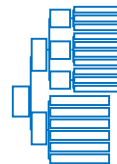
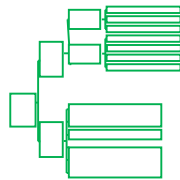
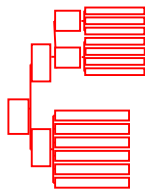
Such models may help clarify where there is agreement or not.

SUMMARY



A key component of systems analysis is examining the perspectives and actions of multiple stakeholders

Constructing hierarchies of objectives for stakeholders provides decision insights



Questions?



**University of California
Irvine**

Appendix

with added details

MULTI-OBJECTIVE MULTI-STAKEHOLDER DECISION ANALYSIS

A key component of systems analysis is examining the perspectives and actions of multiple stakeholders. Constructing a hierarchy of each stakeholder's objectives with respect to a decision situation can provide insights on areas of agreement and disagreement.

Sometimes, one objectives hierarchy is suitable for a set of stakeholders, and differences in opinions across stakeholders can be characterized by differences in the multiple objectives' weights. Examples include planning for protection against radioactive iodine releases in nuclear incidents and analysis for the merger of the Operations Research Society of America and The Institute of Management Sciences to become INFORMS.

In other cases, an objectives hierarchy will be constructed for each stakeholder because their objectives are so different that construction of separate hierarchies better represents their divergent perspectives. Examples include a tuna fish supplier source selection decision (from the perspectives of the StarKist company, environmentalists, and the San Diego tuna fishing fleet), a prostate cancer treatment decision (of former Intel CEO Andy Grove, his family, his company, and his doctors), and the potential siting of a new Home Depot building supply store.

Having modeled stakeholders' objectives, dynamic sensitivity analysis can be conducted using sliders in Excel on the objectives' weights, to rapidly see how the preferred action may change with weight changes. It would also be possible to examine the perceived fairness across stakeholders of anticipated environmental changes or proposed societal policies. Just as groups may differ in objectives, they may also differ in their perception of risks. In particular, scientists and laypeople often judge the magnitude of risks very differently.

MULTIPLE OBJECTIVE DECISIONS UNDER CERTAINTY

Model

Objectives hierarchies of stakeholder(s)

Additive “weight & rate” multiple objective measurable value function

Software

Use Excel with sliders to input swing weights

Show sensitivity analysis in real time as bar graphs change

Much of this material is at <http://faculty.sites.uci.edu/lrkeller/classes/>. LR Keller, JSimon, Y Wang. "Multiple objective decision analysis involving multiple stakeholders," Ch. 7 in M. R. Oskoorouchi (ed.) Tutorials in Operations Research- Decision Technologies and Applications. INFORMS. (2009). [faculty.sites.uci.edu/lrkeller/files/2011/06/multiple-objective-decision-analysis-involving-multiple-stakeholders.pdf]

VALUE RATING SCALE

- 2: SEEN BY **AVERAGE MEMBER AS IMPROVED**
- 1: SEEN BY **OFFICERS AS IMPROVED**
BUT NOT BY AVERAGE MEMBER
- 0: **NO CHANGE**
- 1: SEEN BY **OFFICERS AS WORSE**
- 2: SEEN BY **AVERAGE MEMBER AS WORSE**

INTERPRETATION OF “MEASURABLE” VALUE RATINGS

STRENGTH OF PREFERENCES IS REFLECTED IN
DIFFERENCES OF VALUES

DEGREE OF IMPROVEMENT

FROM 0 TO 1

IS THE SAME AS

FROM 1 TO 2

JUDGED VALUE RATING SCORES

	JUDGED VALUE RATING ON ALTERNATIVES				
OBJECTIVES	SEP	SQ	SM	M2	M3
1. IMPROVE COST EFFICIENCY					
1.1 MAINTAIN EFFICIENT USE OF FUNDS					
1.1.1 EXPLOIT ECONOMIES OF SCALE	-2	0	1	-1	1
1.1.2 BALANCE DUES RATE AND FEE-FOR-SERVICE	-2	0	1	-1	1
1.1.3 REMOVE DOUBLED DUES	-1	0	2	1	2

Evaluation Considerations	Judged Weight	Cooperation Alternative				
		SEP	SQ	SM	M2	M3
1. Improve cost efficiency of TIMS/ORSA operations						
1.1 Maintain efficient use of funds						
1.2 Allocate well revenues/expenses to activities/entities						
1.3 Maintain efficient use of time of volunteers						
2. Enhance the quality of ORSA and TIMS products						
2.1 Provide high quality main and specialty conferences						
2.2 Provide high quality publications						
2.3 Provide appropriate career services						
2.4 Provide support for sub-units						
2.5 Provide other member services						
3. Establish a strong & coherent external image of field						
3.1 Increase visibility and clout of OR and MS						
3.2 Foster professional identity						
4. Manage the scope and diversity of the field						
4.1 Maintain/improve membership composition						
4.2 Create strong relationships with other societies						
5. Maintain/improve effectiveness of ORSA and TIMS operations						
5.1 Maintain/improve quality of governance process						
5.2 Maintain/improve quality of operation output						

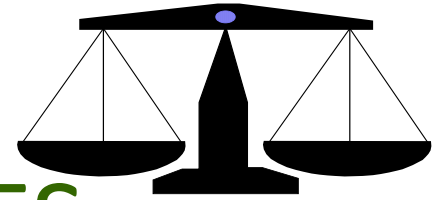
COMPUTE WEIGHTED AVERAGE OF VALUE RATINGS

MULTIPLY OBJECTIVE'S **WEIGHT** TIMES
VALUE **RATING** ON EACH OBJECTIVE

SUM UP OVER ALL OBJECTIVES

(Use **SUMPRODUCT** function in Excel)

RECOMMENDED OPTION IS ONE WITH
HIGHEST OVERALL VALUE



WEIGHTS FOR OBJECTIVES

SUM OF **WEIGHTS** IS 100% FOR ALL LOWEST LEVEL OBJECTIVES

OBJECTIVE'S **WEIGHT DEPENDS ON RANGE**
ATTAINABLE ON OBJECTIVE

Use a SWING WEIGHT Interpretation

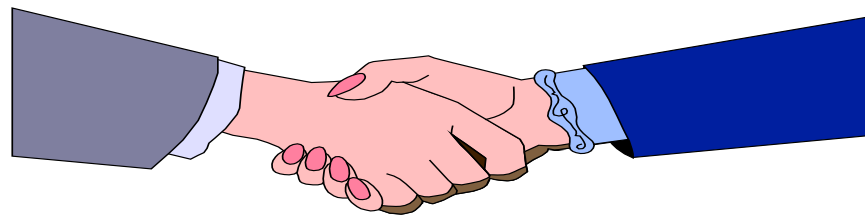
Assume a weighted Additive Model

DECISION MAKER JUDGES WEIGHTS ON OBJECTIVES

RESULTS

OFFICERS PREFERRED MERGER3 ALTERNATIVE

VOCAL OPPONENTS **COMPROMISED** ON **SEAMLESS MERGER**, AS LONG AS NEW NAME included **“OPERATIONS RESEARCH”**



Decision Alternatives Rated with StarKist's "Business-As-Usual" Objectives Hierarchy



	Decision Alternatives		
	Keep Status Quo	Reduce Dolphin Mortality	Go Dolphin Safe
MAXIMIZE PROFIT	?	?	?
B1. Minimize Cost			
B1.1. Minimize Cost of Tuna	+	-	-
B1.2. Minimize Cost of Canning Operations	+	-	-
B1.3. Minimize Cost of Transportation Logistics	+	+	-
B1.4. Maximize Quality of Tuna and Operations	+	+	-
B2. Maximize Revenue			
B2.1. Maintain and Expand Brand Loyalty	?	0	+
B2.2. Increase Customers w/ Differentiated Product Line	?	?	?
B3. Optimize Industry Competitive Position			
B3.1. Capture "First Mover" Advantages	-	0	+
B3.2. Hold Market Share Leadership	?	?	?
B4. Minimize Legal and Regulatory Interference			
B4.1. Minimize Legal Liabilities	?	0	0
B4.2. Minimize Regulatory Intervention	-	-	+
B5. Maintain Favorable Stakeholder Relations			
B5.1. Maintain Good Supplier Relations	+	0	-
B5.2. Maintain Good Shareholder and Banking Relations	?	?	?
B5.3. Maintain Good Relations to Corporate Headquarters	?	?	?
B6. Maintain Reputation as "Good Corporate Citizen"	-	-	+

Key for Rating Alternative's Performance on Objective: "+" : favorable "0" : neutral or balanced
 "-" : unfavorable "?" : insufficient information

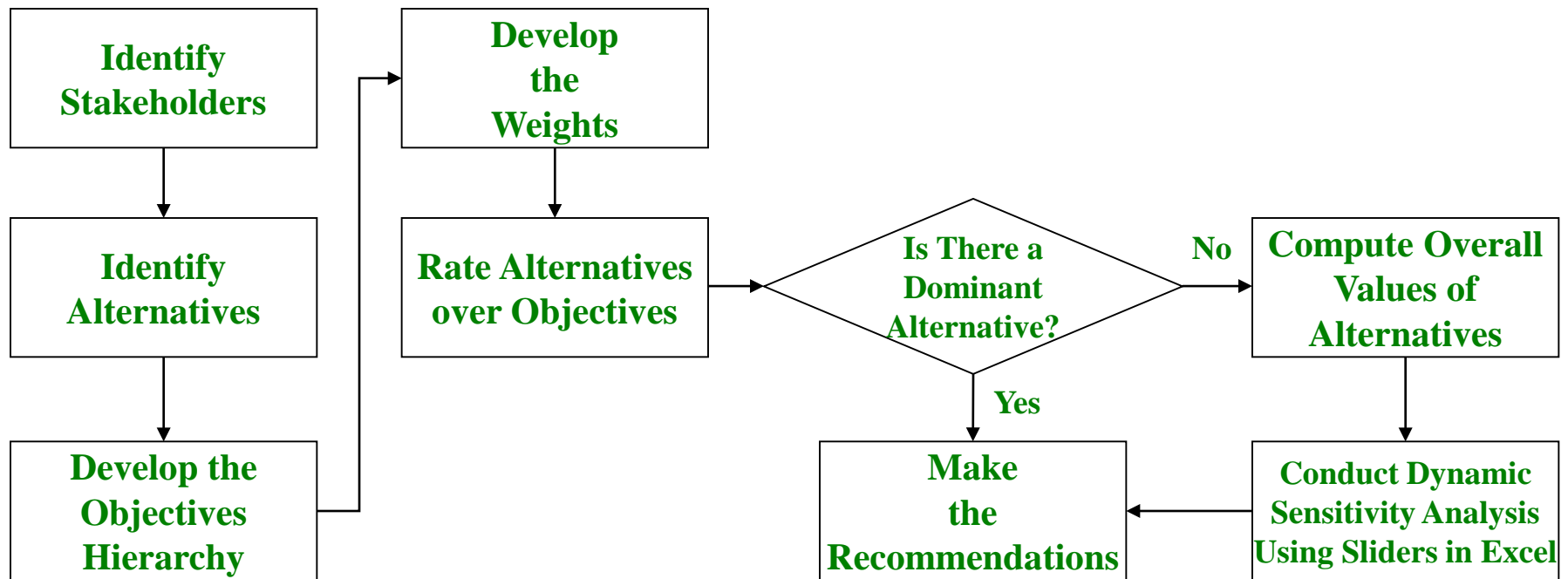
StarKist's "Strategic Planning" Objectives Hierarchy



Objectives Hierarchy	Decision Alternatives		
	Keep Status Quo	Reduce Dolphin Mortality	Go Dolphin Safe
MAXIMIZE PROFIT	?	?	+
S1. Minimize Operational Changes and Restrictions			
S1.1. Manage Profit-Related Changes	+	+	-
S1.1.1 Minimize Restrictions on Fishing Territory	+	+	-
S1.1.2 Maintain Yield	+	+	?
S1.2. Maintain Good Supplier Relations			
S1.2.1 Maintain Control over Distant Fleet	+	+	-
S1.2.2 Minimize Strain on Relations with Local Fleet	+	+	-
S2. Maintain Firm Profitability			
S2.1. Minimize Cost (closely related to S1.1.)	+	+	-
S2.2. Maintain Revenue Stream	?	?	+
S2.2.1. Hold Tuna Price Down	+	+	?
S2.2.2. Avoid Boycotts of Canned Tuna	-	-	+
S3. Maintain Favorable Industry Competitive Position			
S3.1. Remain Market Share Leader	?	?	+
S3.1.1. Hold Leadership Position	?	?	?
S3.1.2. Lead Industry on Pricing and Policy	?	?	+
S3.1.3. Hold Leadership-Related Brand Loyalty	?	?	+
S3.2. Capture "First-Mover" Advantages	-	?	+
S3.2.1. Set Industry Standard on Dolphin Policy	-	+	+
S3.2.2. Maximize Positive Media Coverage	-	-	+
S3.2.3. Maintain Profit Margin with Higher Price	-	?	+
S4. Minimize Government Regulation			
S4.1. Minimize Regulation-Induced Cost Increases	-	+	+
S4.2. Minimize Constraints on Managerial Discretion	-	?	+
S4.2.1. Avoid Compliance or Forced Reactive Mode	-	-	+
S4.2.2. Avoid Regulation-Related Bureaucracy	-	?	+
S5. Improve Firm Reputation & Public Perception			
S5.1. Enhance Image of "Good Corporate Citizen"	-	?	+
S5.1.1. Maximize Goodwill	-	?	+
S5.2.2. Ensure Perceived Legitimacy (Firm & Industry)	-	?	+
S5.2. Avoid Negative Press	-	?	+
S5.3. Minimize Uncertainty from Regulation	?	?	+
S6. Minimize Impact on Marine Life			
S6.1. Minimize Short Term Impact	-	?	+

Methodology

- **A Multi-objective Multi-stakeholder Decision Analysis Methodology**



Stakeholders

- **The city of San Juan Capistrano:** interested in the potential revenue, but concerned with interests of multiple stakeholders
- **Competing local small businesses:** will be influenced by the arrival of Home Depot in terms of profit, etc.
- **Complementary local small businesses:** will definitely be affected in terms of profit, etc.
- **Home Depot**
- **Nearby residents:** concerned with the possible adverse impacts on their quality of life
- **Other area residents:** will enjoy the convenience, but may suffer from the possible increased traffic flow



You can do it. We can help.™



Home Depot in San Juan Capistrano

[A Sample Spreadsheet to Evaluate the Home Depot Case](#)

Excel file (HomeDepotCase.xls)

<http://faculty.sites.uci.edu/lrkeller/classes/>

Make sure to choose "enable the macros" when you open the spreadsheet. If you still have the problem of adjusting the sliders due to the security level after that, please go to the menu of "tools->macro->security", switch the security level from high to medium, save the file, then close the file and finally reopen the file and it should work.