

MCDA: Global vs. Local Scales

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Forest Management MCDA

	Native Timber Production	Forest Recreation	Old-growth Conservation
	m ³ /yr	Visitor-days (M)	%
Increase production	74,000	1.0	40
Status quo	64,275	1.2	60
Decrease production	50,000	1.1	70
Swing Scores	95	40	100
Weights	0.404	0.170	0.426

New Option

	Native Timber Production	Forest Recreation	Old-growth Conservation
	m ³ /yr	Visitor-days (M)	%
Increase production	74,000	1.0	40
Status quo	64,275	1.2	60
Decrease production	50,000	1.1	70
Drop production, close forest partly	60,000	0.8	70
Old range	24,000	0.2	30
New range	24,000	0.4	30

New Weights

	Native Timber Production	Forest Recreation	Old-growth Conservation
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New range	24,000	0.4	30
Old swing scores	95	40	100
Old weights	0.404	0.170	0.426
New swing scores			
New weights			

New Weights

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Old weights	0.404	0.170	0.426
New swing scores	95	80	100
New weights	0.345	0.291	0.364

Range adjustments

- $$w(i) = \frac{W(i) \frac{r(i)}{R(i)}}{\sum_j W(j) \frac{r(j)}{R(j)}}$$
 - $w^*(i)$ is the new weight on objective i
 - $W(i)$ is the old weight on objective i
 - $R(i)$ and $r(i)$ are the old and new ranges for objective i , respectively

The problem is...

- Often, when you change the range, and ask people to re-weight, they don't do it enough
- Range Sensitivity Index (RSI)

- $$RSI_i = \frac{\frac{w_i}{1-w_i} - \frac{W_i}{1-W_i}}{\frac{w^*_i}{1-w^*_i} - \frac{W_i}{1-W_i}}$$

- Should be 1.0

RSI in practice

- A number of studies have tested range sensitivity indices
- RSI's are typically less than 1
 - Where people have a lot of experience, the RSI's tend to be small
 - When people are forced to look at cross-attribute comparisons, RSI's are closer to 1

Cognitive explanations

- The mental calculations for swing-weighting may be too taxing
- People may interpret objective weights as intrinsic values that don't vary with the situation
 - Do we carry with us global scales for attributes we're familiar with (cars prices, cereal prices, etc.)?
- Swing weighting creates psychological conflict
 - Assigning low weight to the most important objective because its range is small

Alternative: Global Scales

- Instead of weighting based on local ranges, defer to the cognitive predisposition of the decision maker, and use global ranges
- Two steps
 - Elicit those global ranges
 - Elicit “importance weights”

Global scales

- *Experiential global scale
- *Imagined global scale
- Aspirational global scale
- Universal global scale
- Constrained global scale

Global scale construction

- Ask the decision maker to select attribute values from the natural scale that
 - Are “excellent”, worth highest score
 - Are “terrible”, worth lowest score
- They need not specify what kind of global scale they’re thinking of

Importance Weights

- Weights that reflect the overall importance of the objectives
 - That is, over the global scale
- Elicitation
 - Disregard the particular example
 - Rank the attributes
 - Score the attributes (100 for best, etc.)

MCDA with global scales

- In the analysis, use the global scales to re-scale the attributes (to 0,1)
- Use the importance weights to combine across objectives

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Decrease production	50,000	1.1	70
Global scale	0 – 74,000	0.0 – 1.6	0 - 100
Importance:			
Scores	90	60	100
Weights	0.36	0.24	0.40

Local scales

- Why do we even use local scales in MCDA?
 - Preferential independence
 - Linearity over smaller range
 - Easier to think about value over small range

Is swing weighting so bad?

- The method of elicitation for local scales matters (Fischer 1995)
 - Best: tradeoff methods
 - Next: swing weighting
 - Worst: direct weighting

Are global scales better?

- People do tend to violate the range sensitivity principle
 - Under-adjust for range
- Both method associate weights with ranges
 - Global scales are implicit
- Are global scales easier?