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Best Practices in Multi-Criteria Evaluations

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Best Practices

- Proper Definition of Criteria
  - Conduct a Value-Focused Evaluation
  - Observe Properties for the Criteria
  - Define Adequate Attributes
- Correct Elicitation of Preferences
  - Elicit Correctly Value Functions
  - Elicit Correctly Trade-offs (Criteria Weights)
- Suitable Modelling Processes

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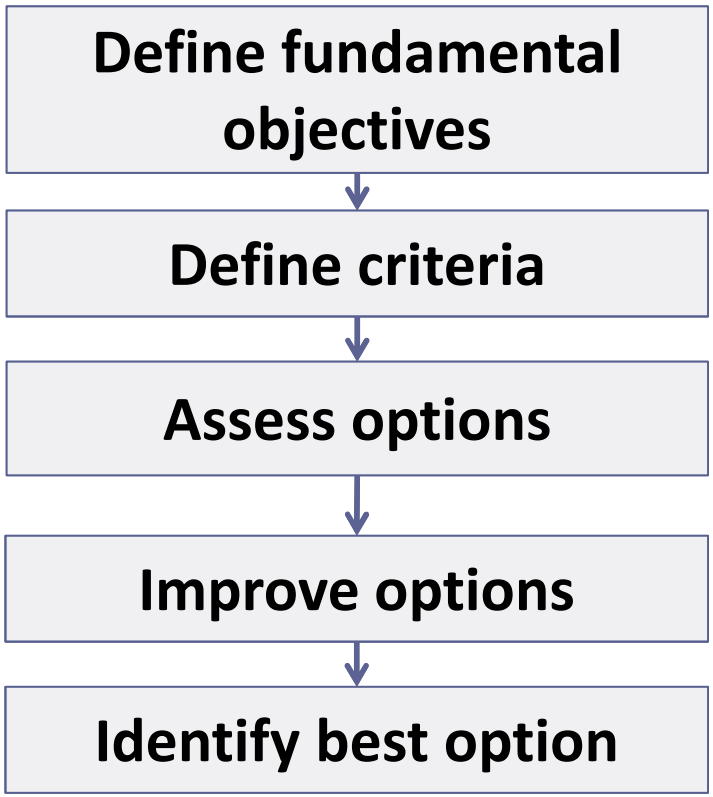
Value-Focused Evaluations



Advantages of this approach:

- Criteria measure achievement of fundamental objectives.
- It allows the evaluation of a large number of options.
- Supports search for good options, as values have been modelled.
- Focus is on maximising value and on designing better options.

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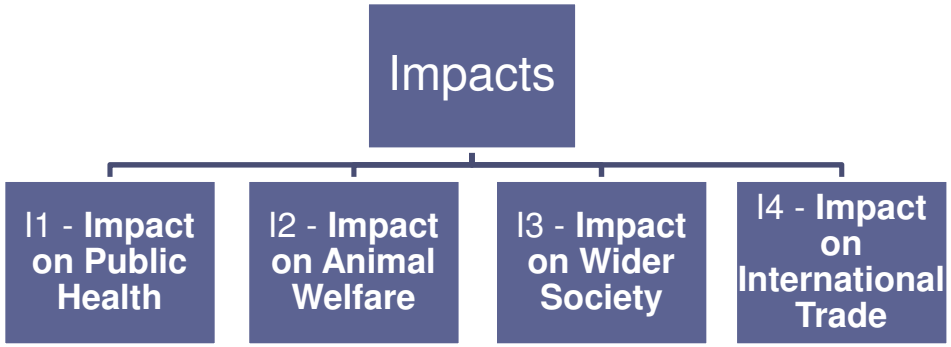
Define Criteria Set



- Properties
  - Measure achievement of fundamental objectives
  - Consider fundamental objectives only
  - Make right decomposition of objectives into sub-objectives
  - Avoid double counting
  - Make sure they are preferentially independent

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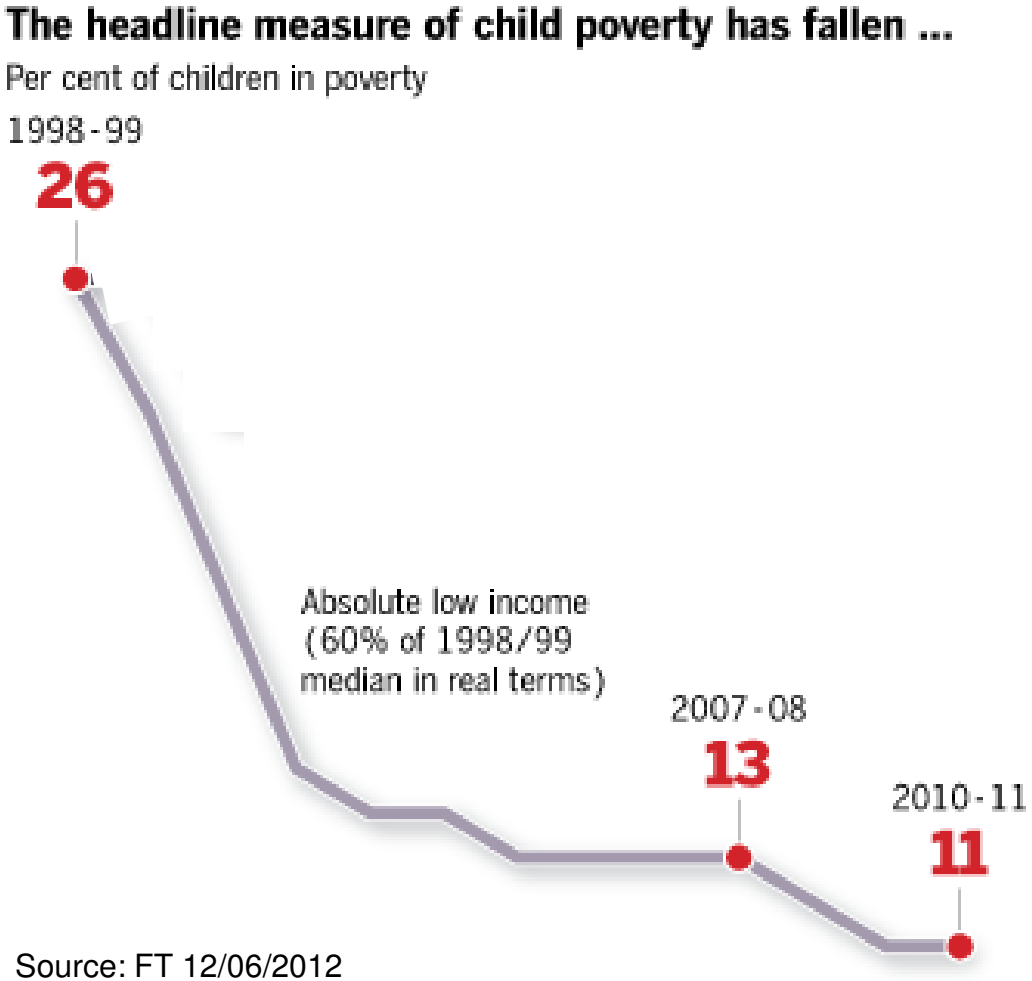
Defining a suitable attribute for an objective



Source: FT 12/06/2012

Is this objective being achieved (1998-2008)?

Or not so much?

The attribute must directly describe the consequences of interest!

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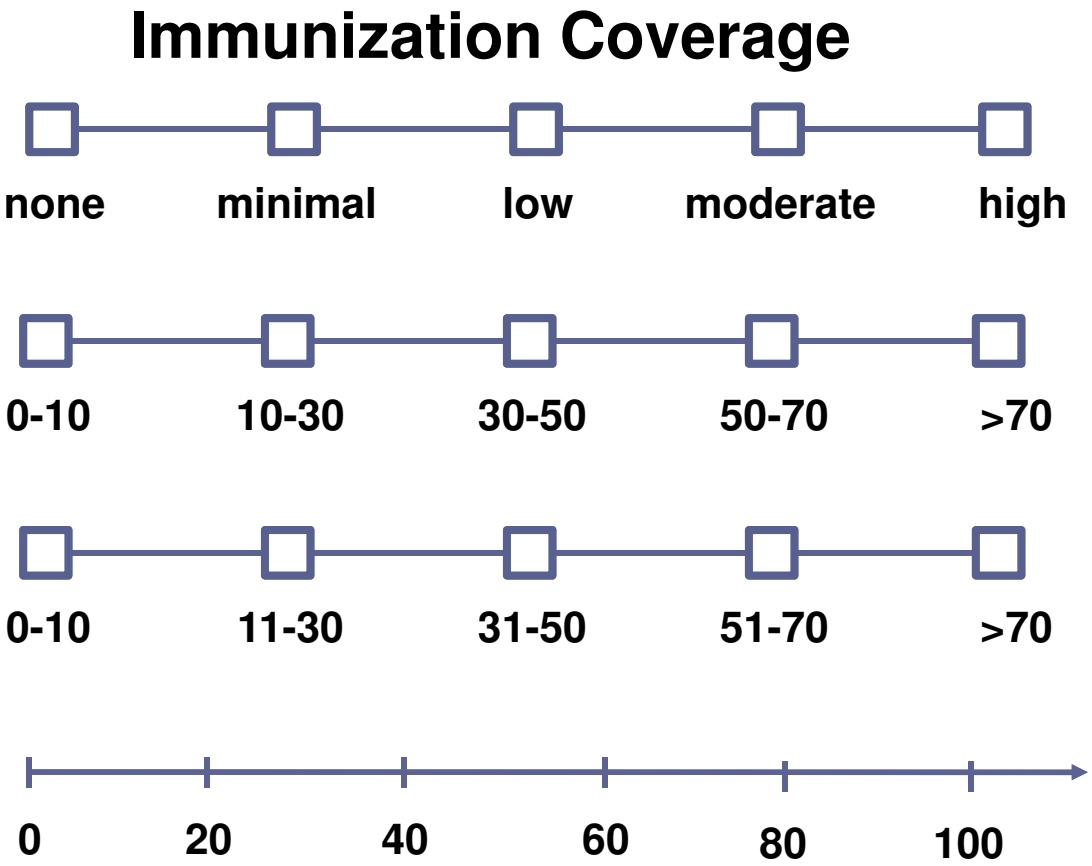
Define Adequate Attributes



Adapted from R. L. Keeney (1992) Value Focused Thinking. Harvard Univ. Press (p. 116)

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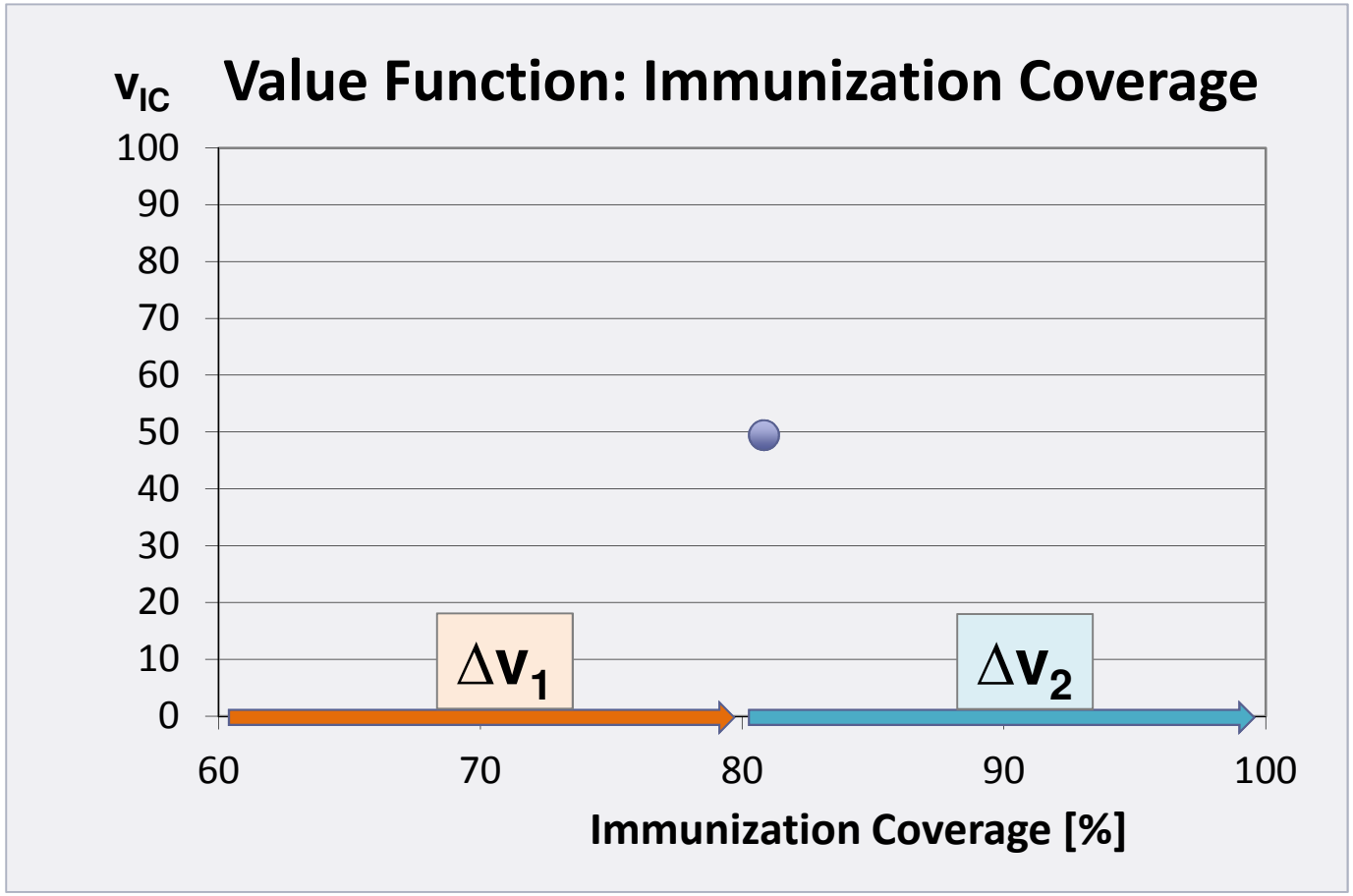
Eliciting Correctly Value Functions



$$\Delta v_1 > \Delta v_2$$

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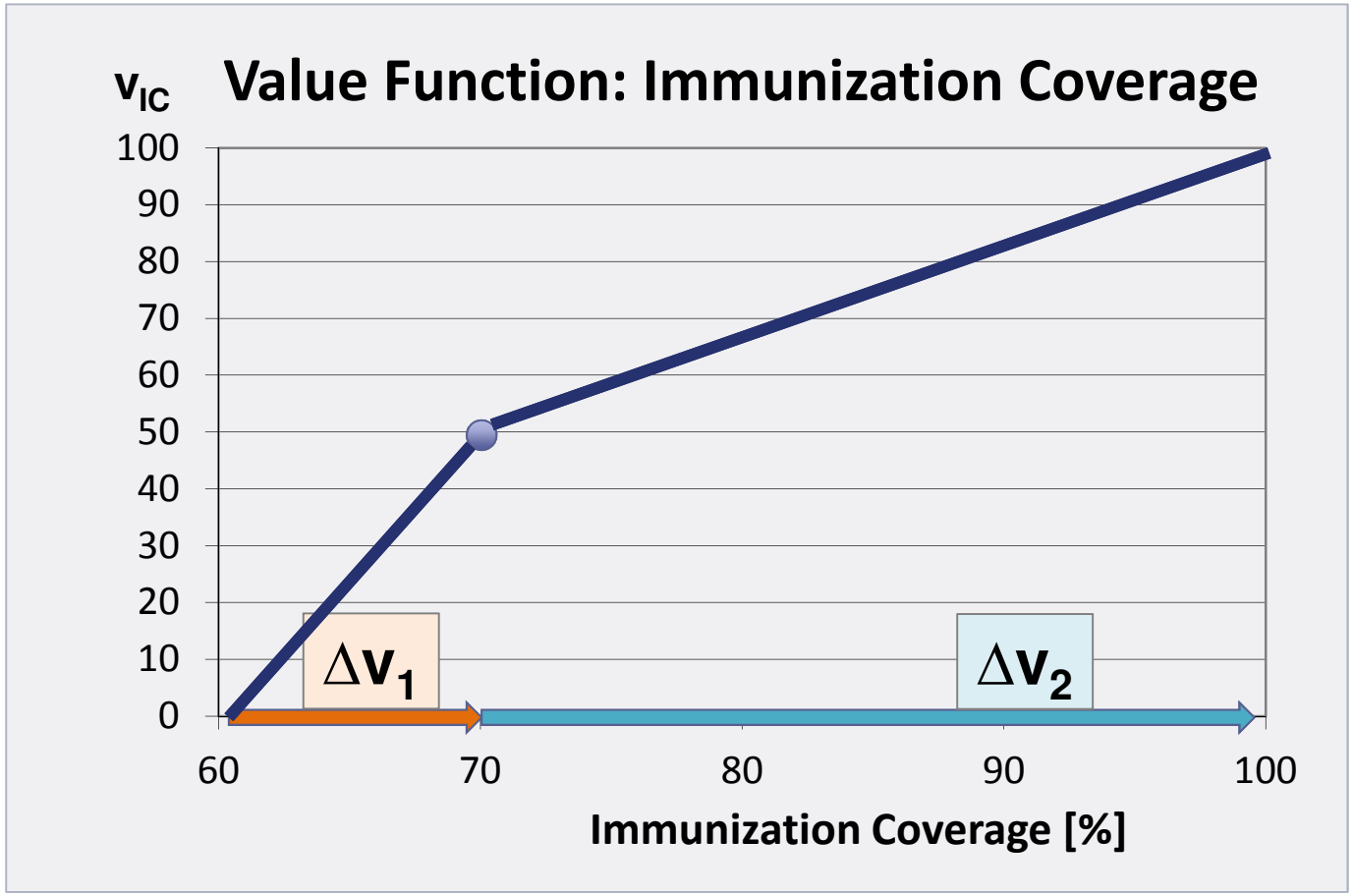
Eliciting Correctly Value Functions



$$\Delta v_1 = \Delta v_2$$

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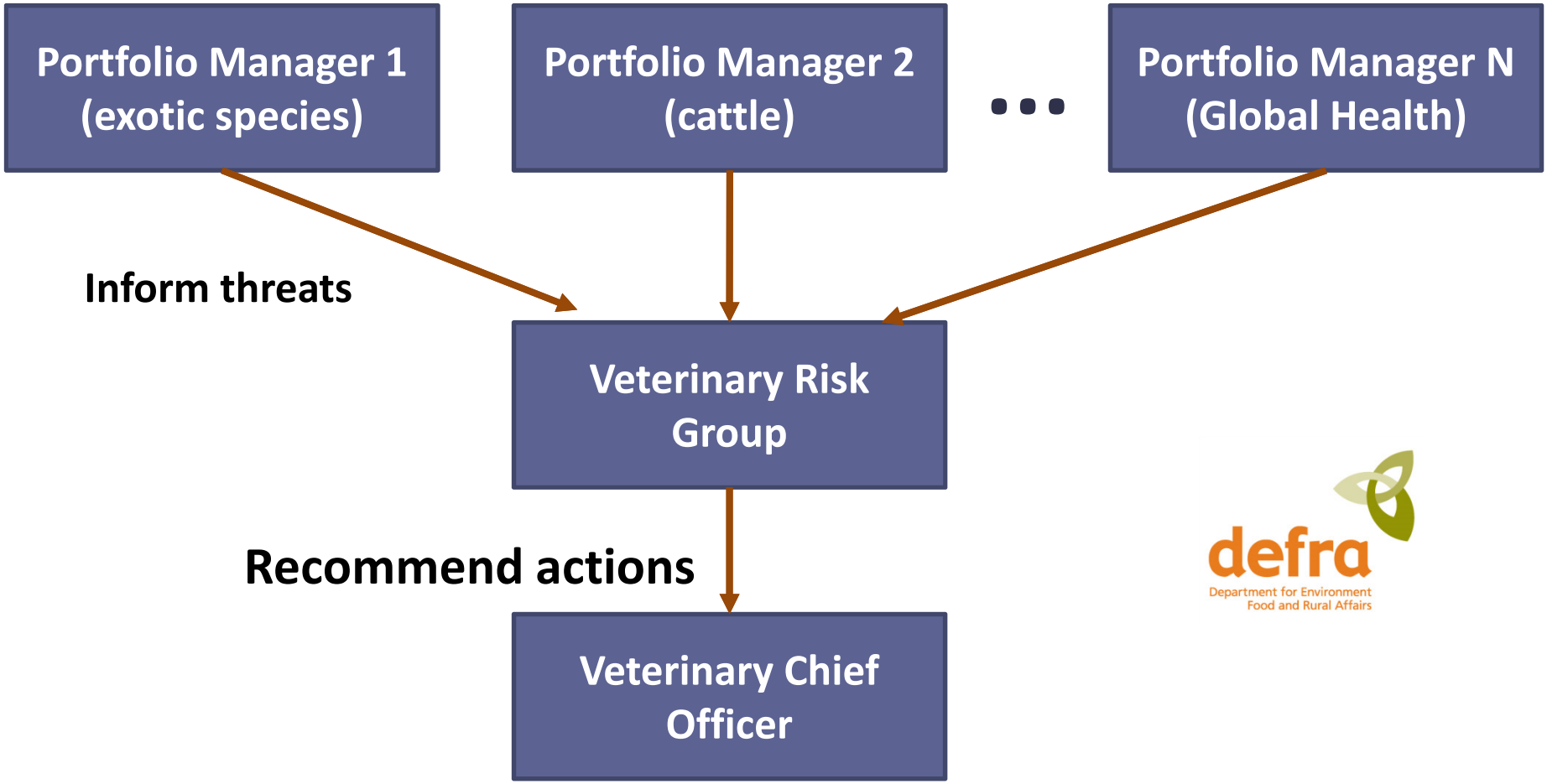
Assessing Emergent Animal Health Threats for Defra



defra
Department for Environment Food and Rural Affairs

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FARMERS WEEKLY INTERACTIVE

MAKING THE FARMING CONNECTION

Bleeding calf syndrome on the rise

Aly Balsom
Monday 21 September 2009 17:03

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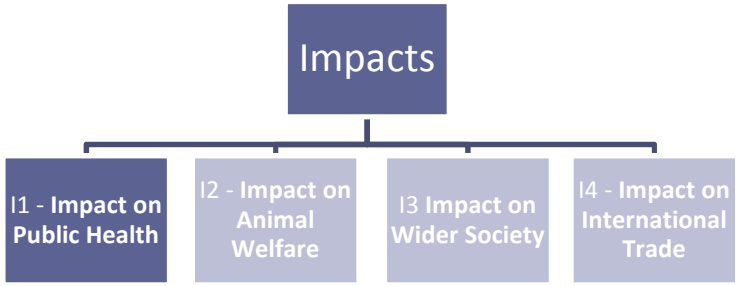
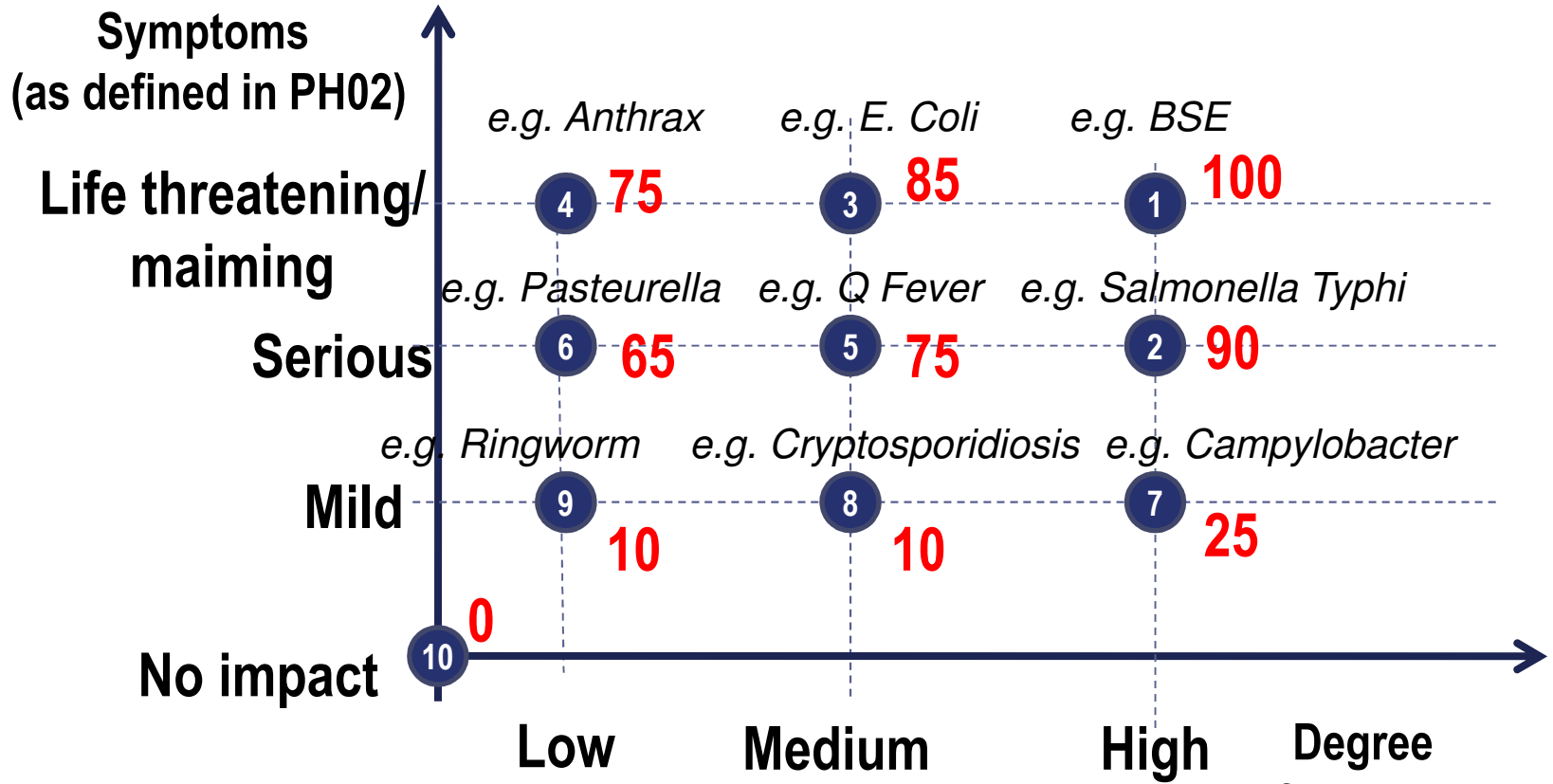


I1 - Impact on Public Health: The degree of potential impact on public health that the animal threat/disease may cause.



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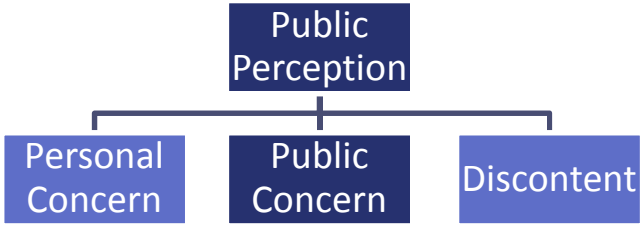
Public Concern



100 — 1 — Severe suffering on species dear to the public
High potential media interest
(e.g. rabies in puppies)

90 — 2 — Some suffering on species dear to the public
High potential media interest
(e.g. killing of badgers to control TB)

65 — 3 — Some suffering on species the public is less concerned with
High potential media interest
(e.g. as BTV8 in cattle)

35 — 4 — Some suffering on species the public is not concerned with
High potential media interest
(e.g. Newcastle in poultry)

0 — 5 — No suffering on species the public is not concerned with
Low media interest
(e.g. infectious salmon anemia in salmon)

Public Concern: The degree of potential public concerns about the animal threat /disease, in terms of animal suffering and affective connection to the species.

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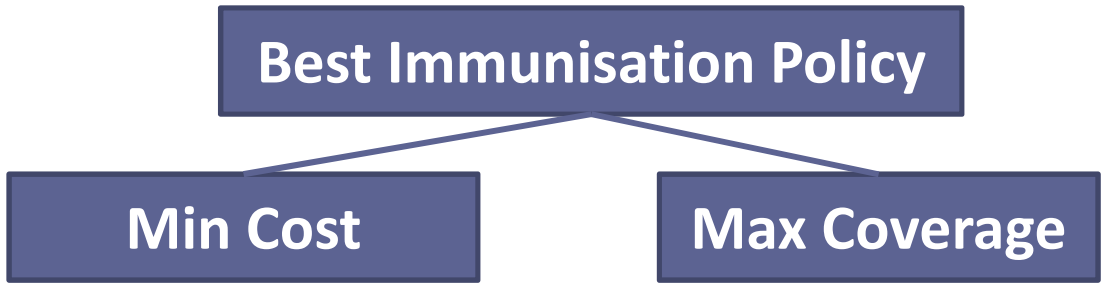
Elicit Correctly Criteria Weights



- Avoid questions of direct importance – they are meaningless!
- Define suitable attributes
- Identify the ranges for each attribute
- Use questions that elicit value trade-offs

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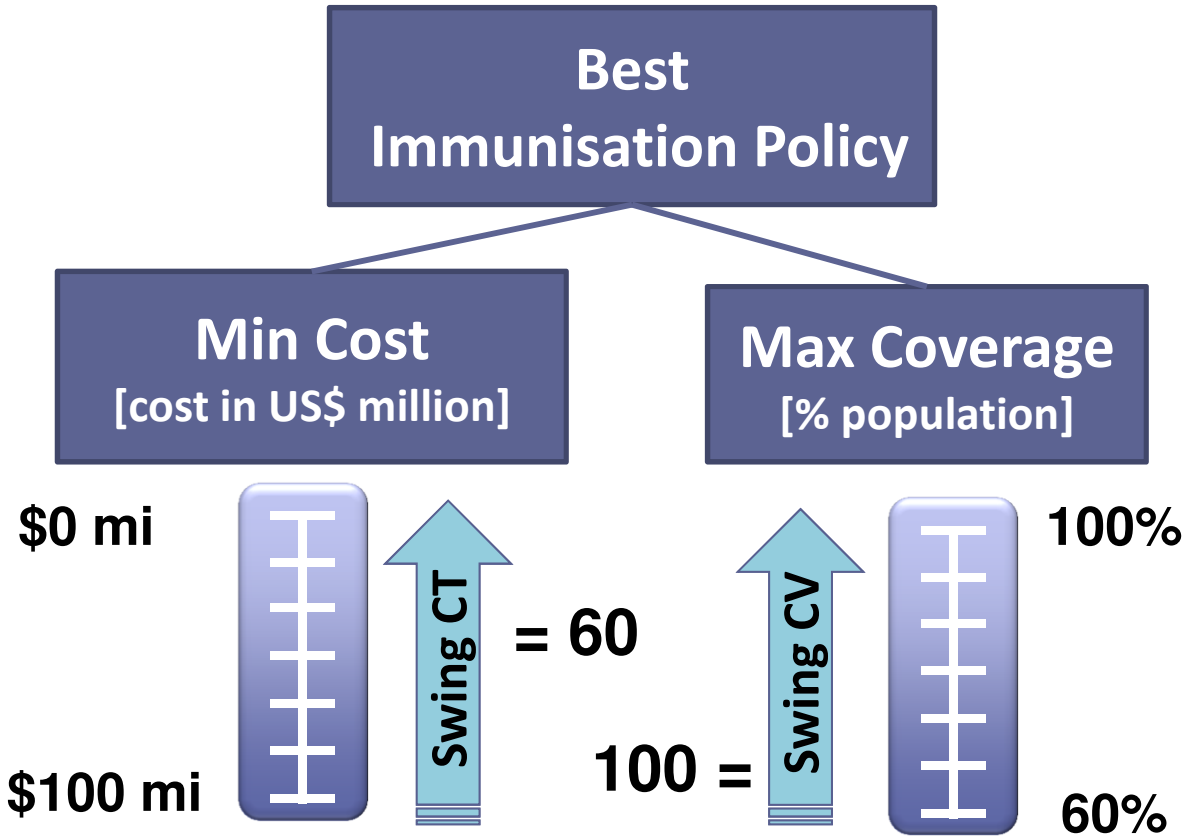
Elicit Correctly Criteria Weights



w_{CT} = 60/160 = 37%

w_{CV} = 100/160 = 63%

Swing-weights:

Swing CT or CV?

Decision Maker: "Swing CV"

Value Swing CV = 100

Value Swing CT?

Decision Maker: "60"

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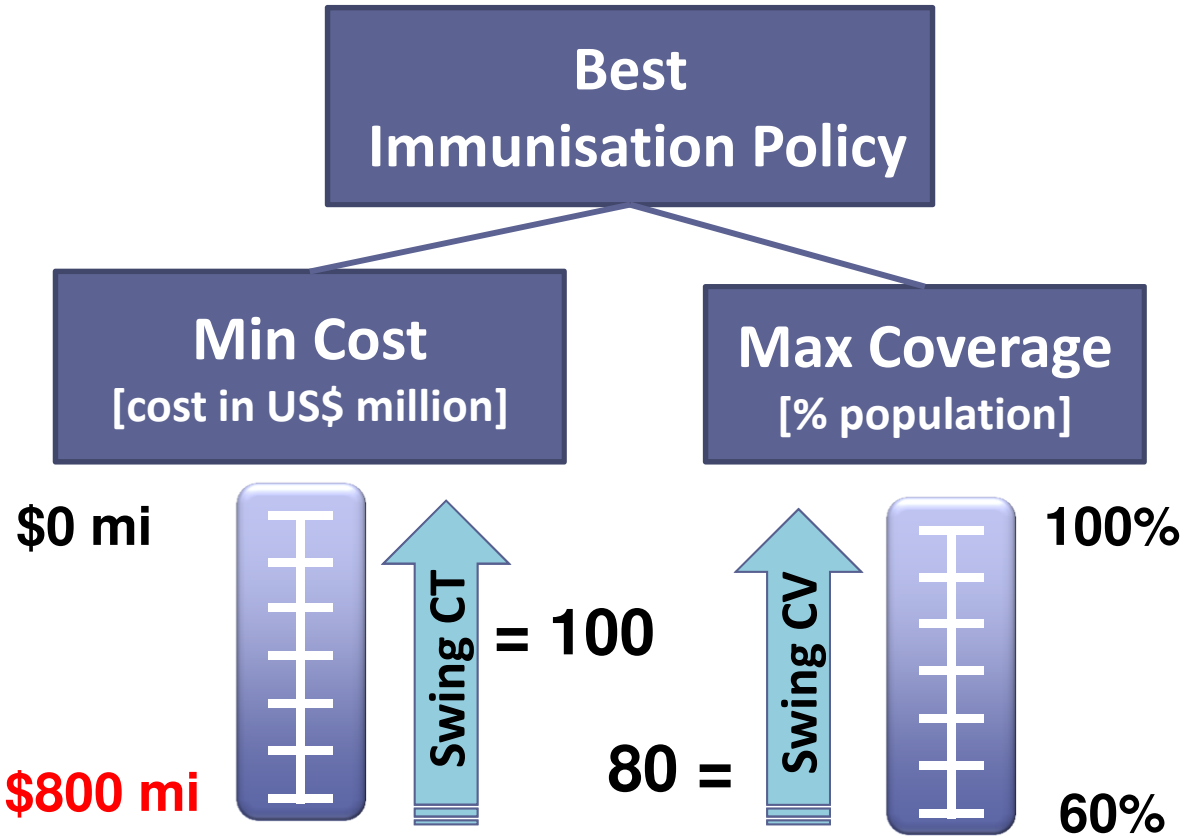
Elicit Correctly Criteria Weights



w_{CT} = 100/180 = 55%

w_{CV} = 80/180 = 45%

Swing-weights:

Swing CT or CV?

Decision Maker: "Swing CT"

Value Swing CT = 100

Value Swing CV?

Decision Maker: "80"

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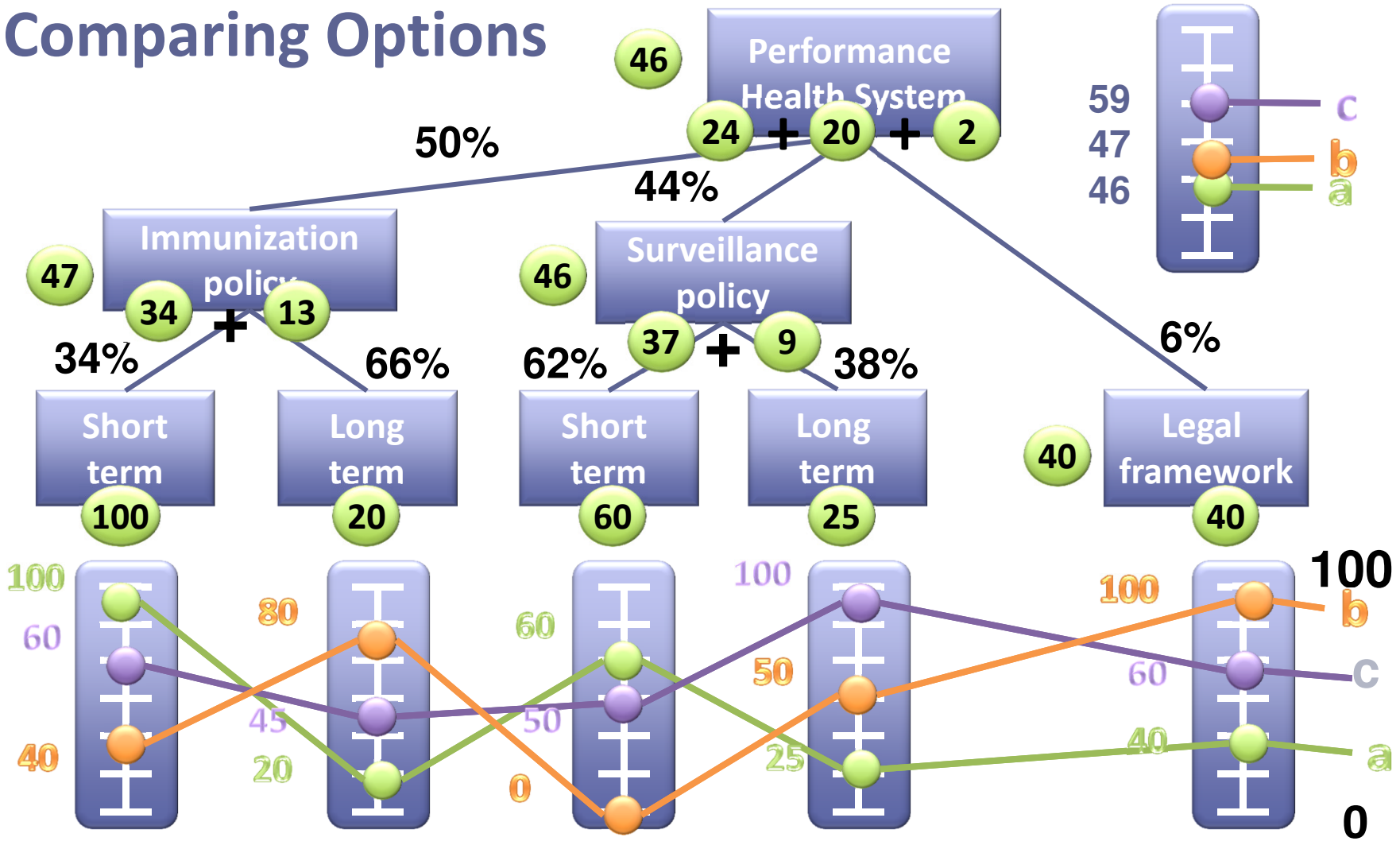
Comparing Options



a_1: 26.4/18 = 1.46/$mi

a_2: 12.5/10 = 1.25/$mi

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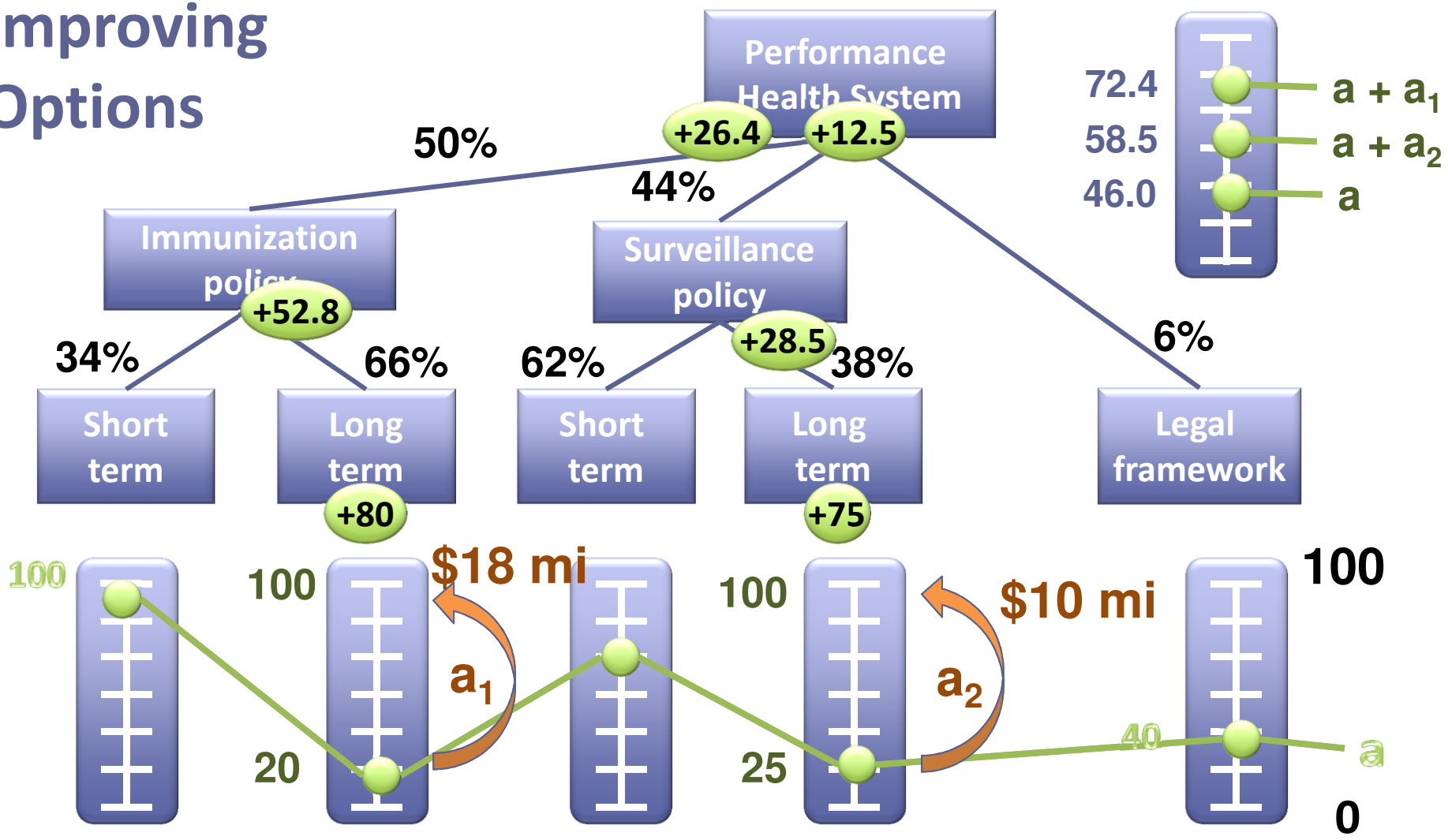
Improving Options



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Modelling Processes: Participative and Interactive Models

Facilitated Decision Analysis

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Multi-Criteria Decision Support Systems

		Sort Impacts	Sort PO	Sort Capabilities	Prioritise I/C	Prioritise PO/I	Breakdown of Capabilities		
Threats	Risk Path	Impacts	Public Opinion	Capabilities	Impacts/Capabilities I/C	Public Opinion/Impacts PO/I	C1 - Evidence Assessment	C2 - Resources	C3 - Counter-Measures
Fay 2	Risk Path - please do not forget to input the risk path for this threat.	63.94	46.54	24.62	2.6	0.7	20	40	10
Fay 5		50.64	50.77	45.23	1.1	1.0	21	100	1
Fay 6		24.36	64.23	36.08	0.7	2.6	22	45	39
Fay 7		100.00	100.00	100.00	1.0	1.0	100	100	100
Fay 9		75.53	77.69	58.00	1.3	1.0	100	70	1
Victor 2	Risk Path - please do not forget to input the risk path for this threat.	63.94	46.54	24.62	2.6	0.7	20	40	10
Victor 5		50.64	50.77	45.23	1.1	1.0	21	100	1
Victor 6		24.36	64.23	36.08	0.7	2.6	22	45	39
Victor 7		100.00	100.00	100.00	1.0	1.0	100	100	100
Victor 9		75.53	77.69	58.00	1.3	1.0	100	70	1
Sumitra 2	Risk Path - please do not forget to input the risk path for this threat.	63.94	46.54	24.62	2.6	0.7	20	40	10
Sumitra 5		50.64	50.77	45.23	1.1	1.0	21	100	1
Sumitra 6		24.36	64.23	36.08	0.7	2.6	22	45	39
Sumitra 7		100.00	100.00	100.00	1.0	1.0	100	100	100
Sumitra 9		75.53	77.69	58.00	1.3	1.0	100	70	1

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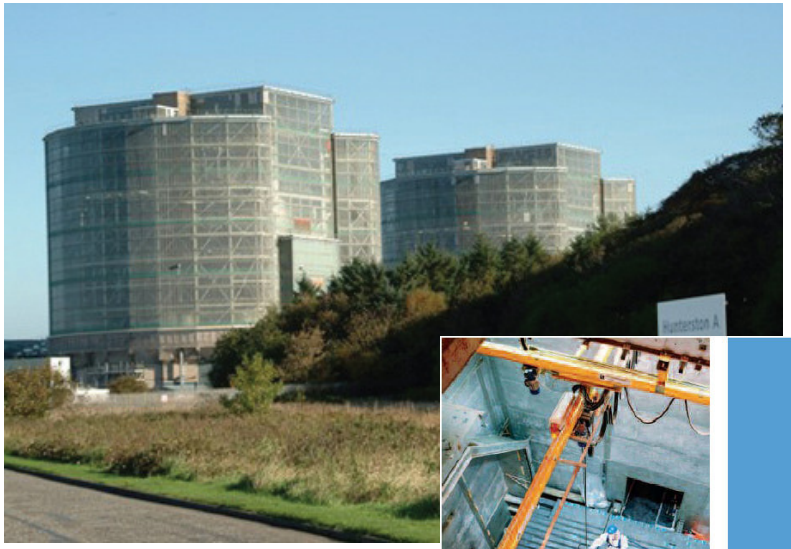
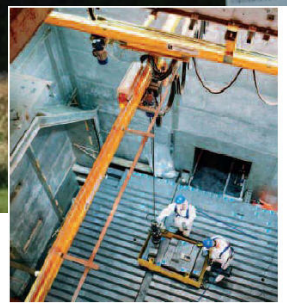
Modelling Processes: Online distributed evaluations





Nuclear Waste Management

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Eliciting Value Functions Online

Consider the effec

Which decrease ir

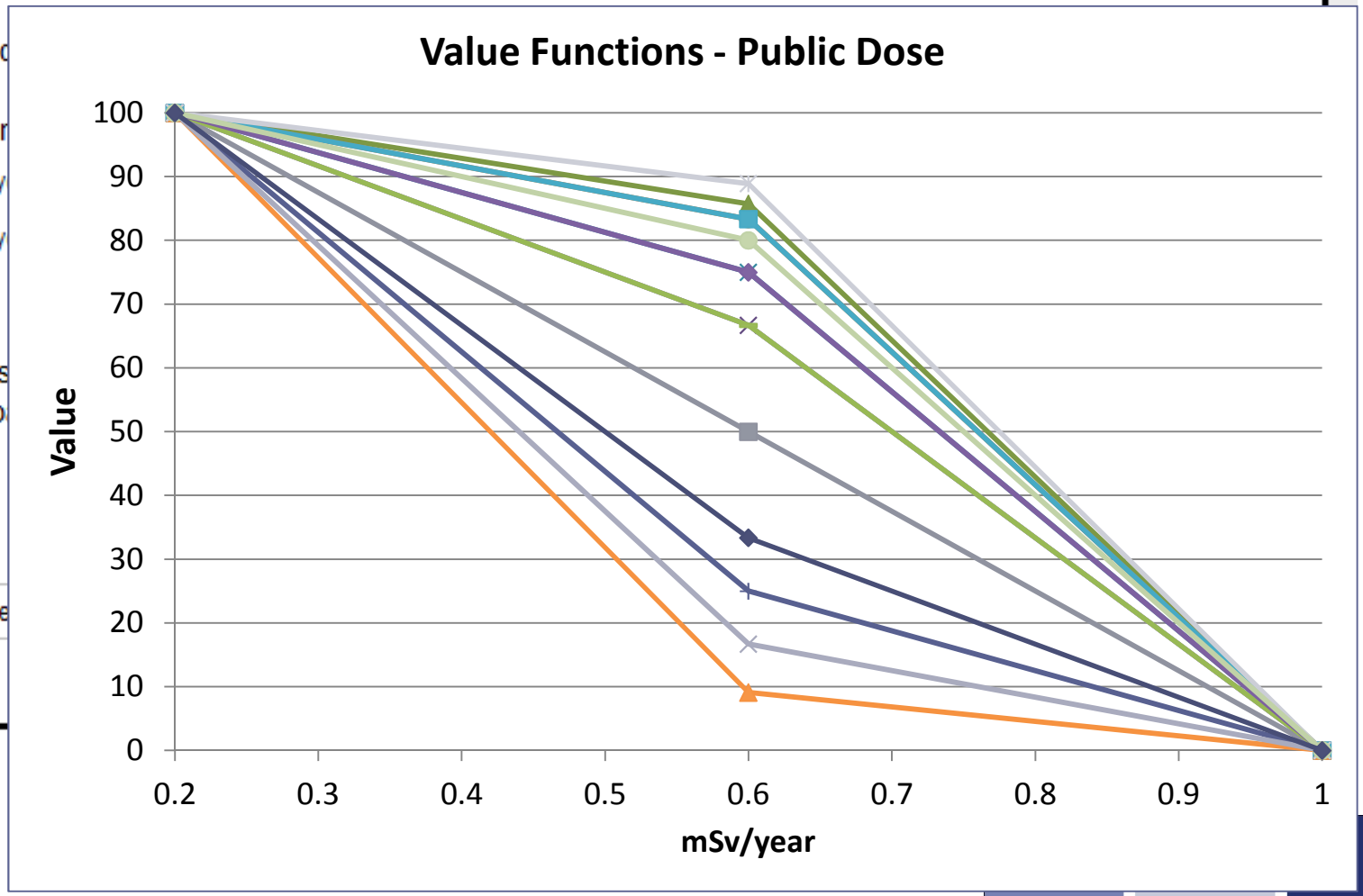
From 1.0 mSv/y

From 0.6 mSv/y

How many times is

Please drag the b

Numbe



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Eliciting Criteria Weights Online

Consider two disposal options, which are assessed taking into account only two main criteria:

- Safety of the Public (measured as public dose)
- Lifetime cost.

Which option would you prefer?

- Option A: public dose is 0.5 mSv/year and lifetime cost is £5 million
- Option B: public dose is 0.6 mSv/year and lifetime cost is £1 million

How many times the most preferred is option better that the least preferred option? Please drag the bar below.

	1	2	3	4	5	6	7	8	9	10
Number of times:										

Question: Swing?

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Eliciting Criteria Weights Online

Which criterion do you consider more important in the assessment of disposal options?

- Lifetime cost
- Safety of the Public

How many times is the most important criterion worth in relation to the least important criterion? Please drag the bar below.

	1	2	3	4	5	6	7	8	9	10
Number of times:										

Question: Importance?

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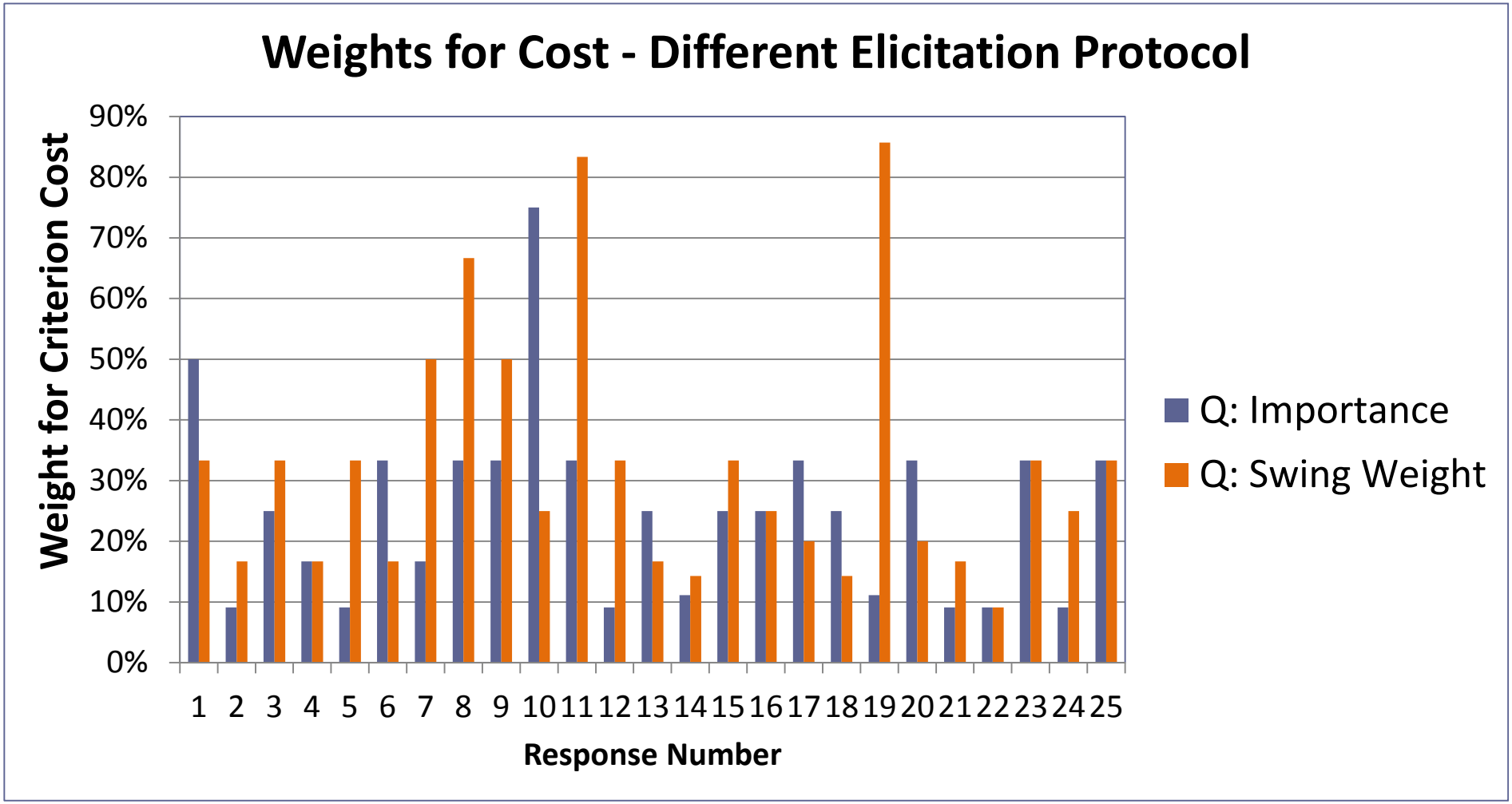

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Are these concepts being used in practice?

defra Department for Environment Food and Rural Affairs

ITAIPU BINACIONAL

NAO National Audit Office

UKAEA babcock

Coventry City Council

Warwickshire County Council

SEBRAE Serviço Brasileiro de Apoio às Micro e Pequenas Empresas

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Thank you for your attention!

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Useful References

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