Sustainable Remediation: Perspectives from across the ‘pond’

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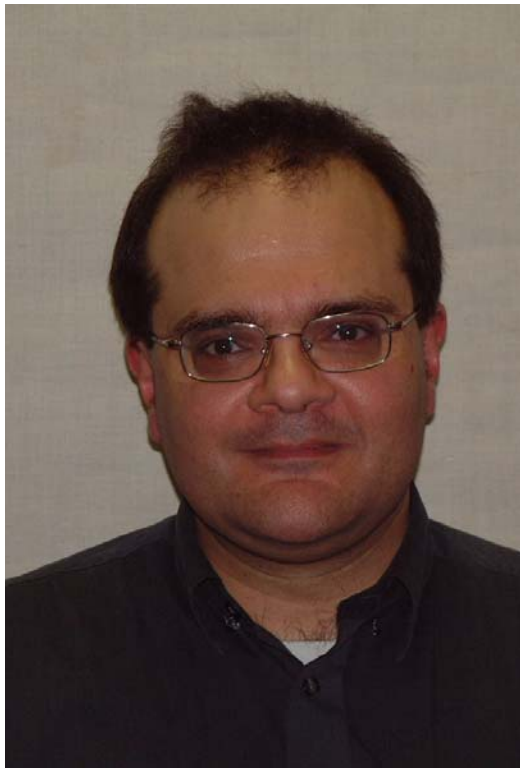
Global Perspectives on Green Remediation: Making Clean “Green”
California Environmental Protection Agency
Department of Toxic Substances Control
4 February 2009, Sacramento CA

Your presenters

- Paul Bardos

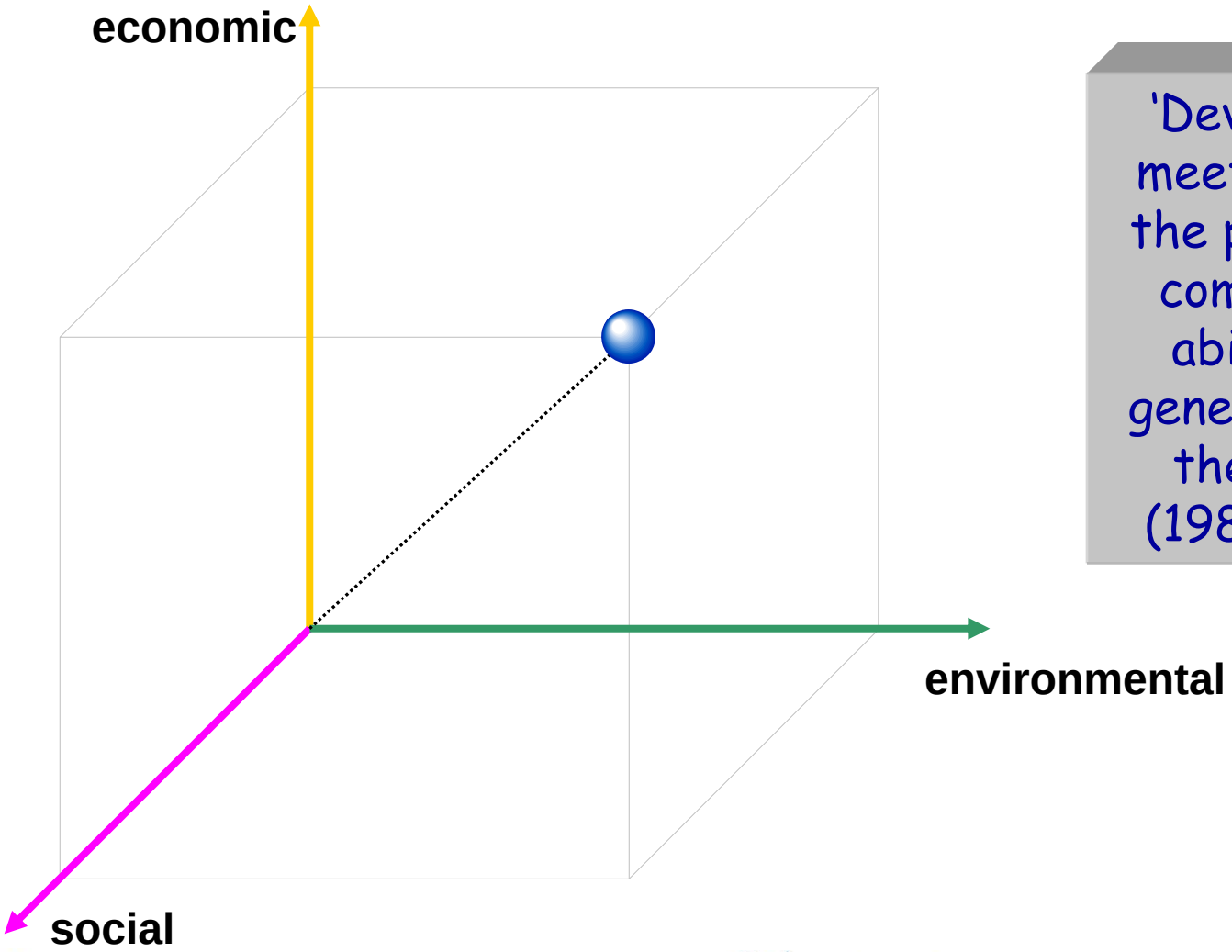
- Paul Nathanail



Paul Bardos

- Managing Director: r3 environmental technology ltd (www.r3environmental.com), Visiting Professor at the Universities of Nottingham and Reading
- Originally a soil microbiologist
- Interests include: contaminated land management, recycling and composting, waste management and synergies with renewables as well as sustainable remediation more generally (since 1995), and increasingly soils / river basins
  - Sustainable Remediation Forum – UK
  - Manager EUGRIS (www.eugris.info)
  - Member EURODEMO (www.eurodemo.info)
  - UK representative to CLARINET (www.clarinet.at)
  - NICOLE information manager
  - (www.nicole.org) and many others.
  - UK representative NATO/CCMS Renediation "Pilot Studies" 1988 to 2002

Sustainability



'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (1987, Brundtland)

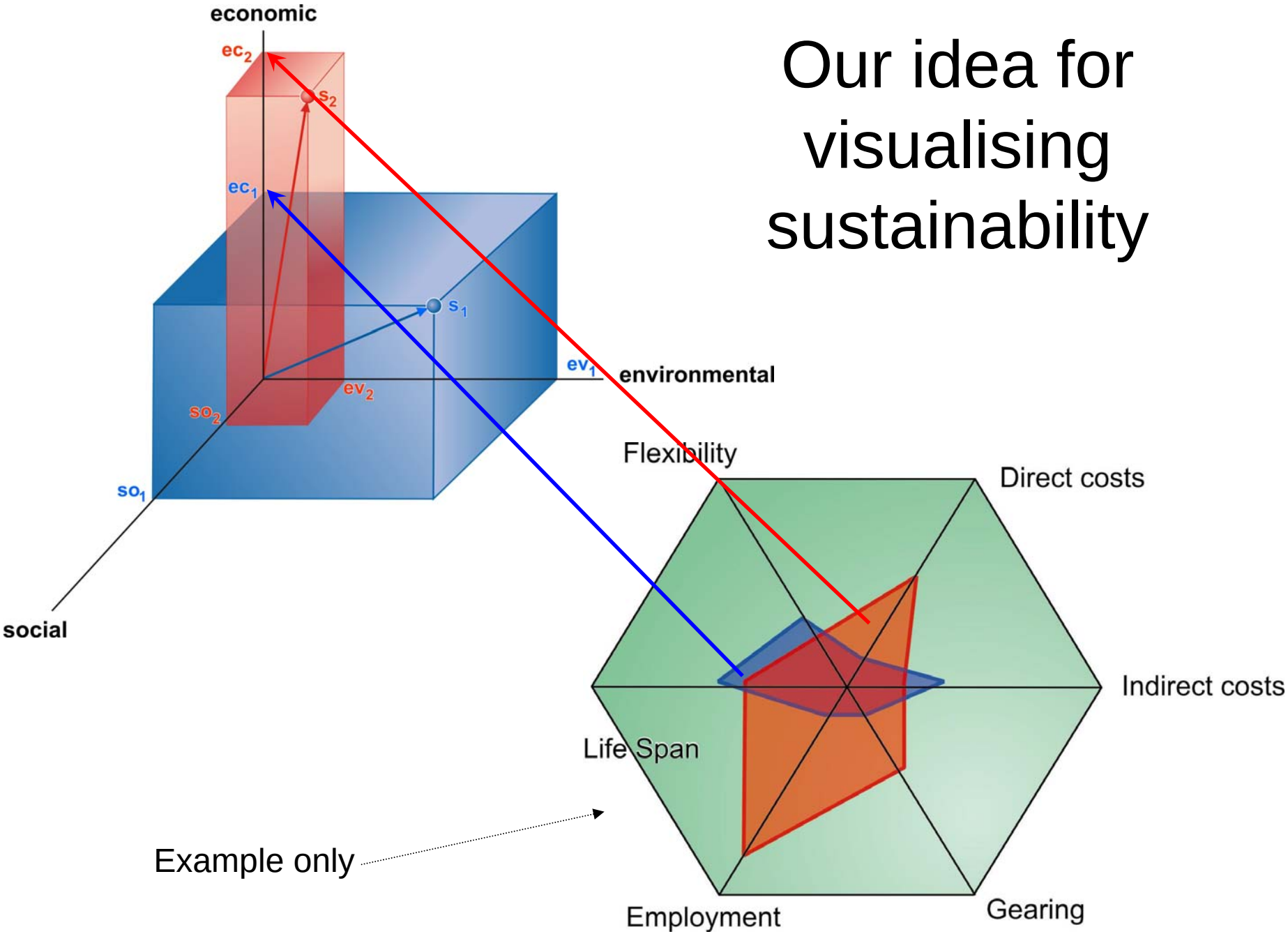
How can sustainability be assessed?

- There is no “standard” technique like ISO 14040 for LCA
- Approaches use indicators
  - Metrics / assessments of individual factors that contribute to an overall understanding of sustainability
    - E.g. direct costs, greenhouse gas emissions etc
- And some means of aggregating individual assessments of indicators to provide an overall understanding
  - Qualitatively – e.g. using some kind of ranking table
  - Quantitatively – e.g. using some form of valuation like CBA

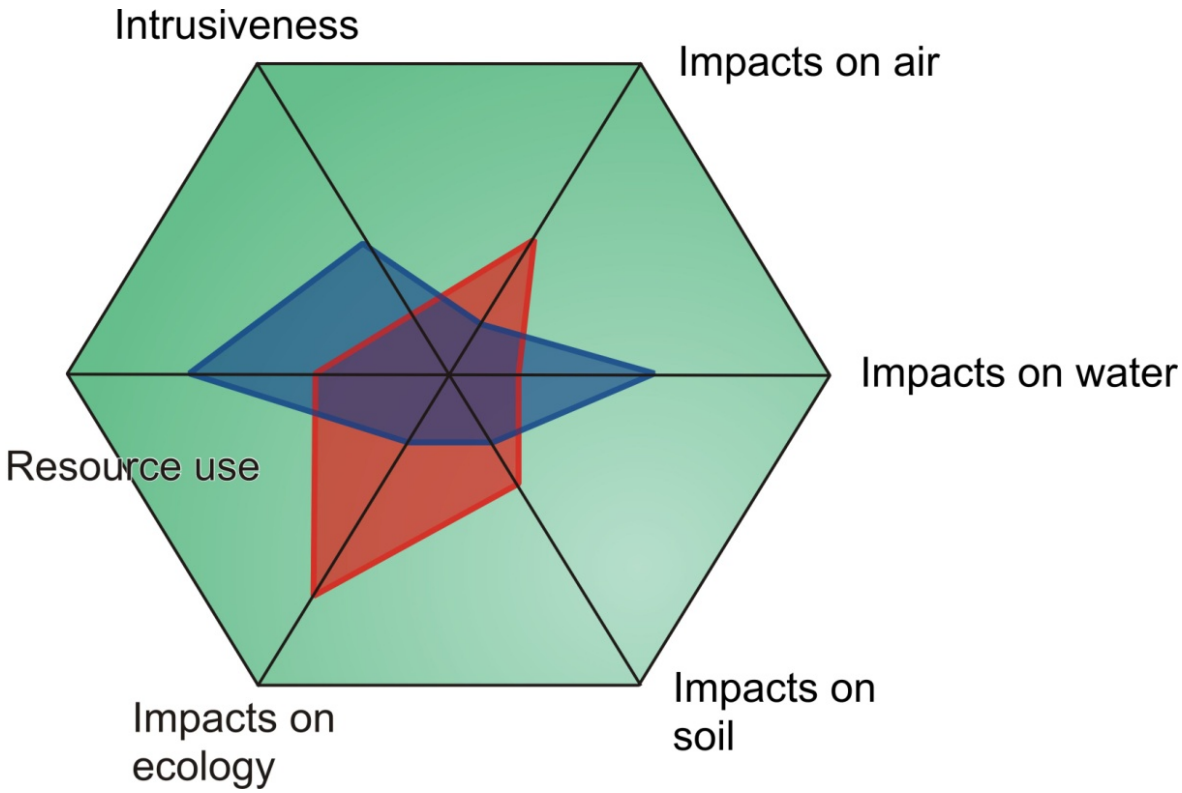
What kind of indicators?

- Two broad approaches:
  - Policy orientated indicators that are linked to specific policy goals, often with some threshold or target for “acceptability” included.
    - E.g. England Sustainable Development Policy: Framework Indicators (www.defra.gov.uk/sustainable/government/publications/uk-strategy/framework-for-sd.htm)
    - E.g. UK Regional development strategies (www.communities.gov.uk/index.asp?id=1161341)
  - Indicators that are orientated towards consistent reporting of sustainability effects independent of particular regional, national or international policy goals
    - E.g. Global Reporting Initiative (http://www.globalreporting.org)
- Obviously there is scope for overlap

Our idea for visualising sustainability



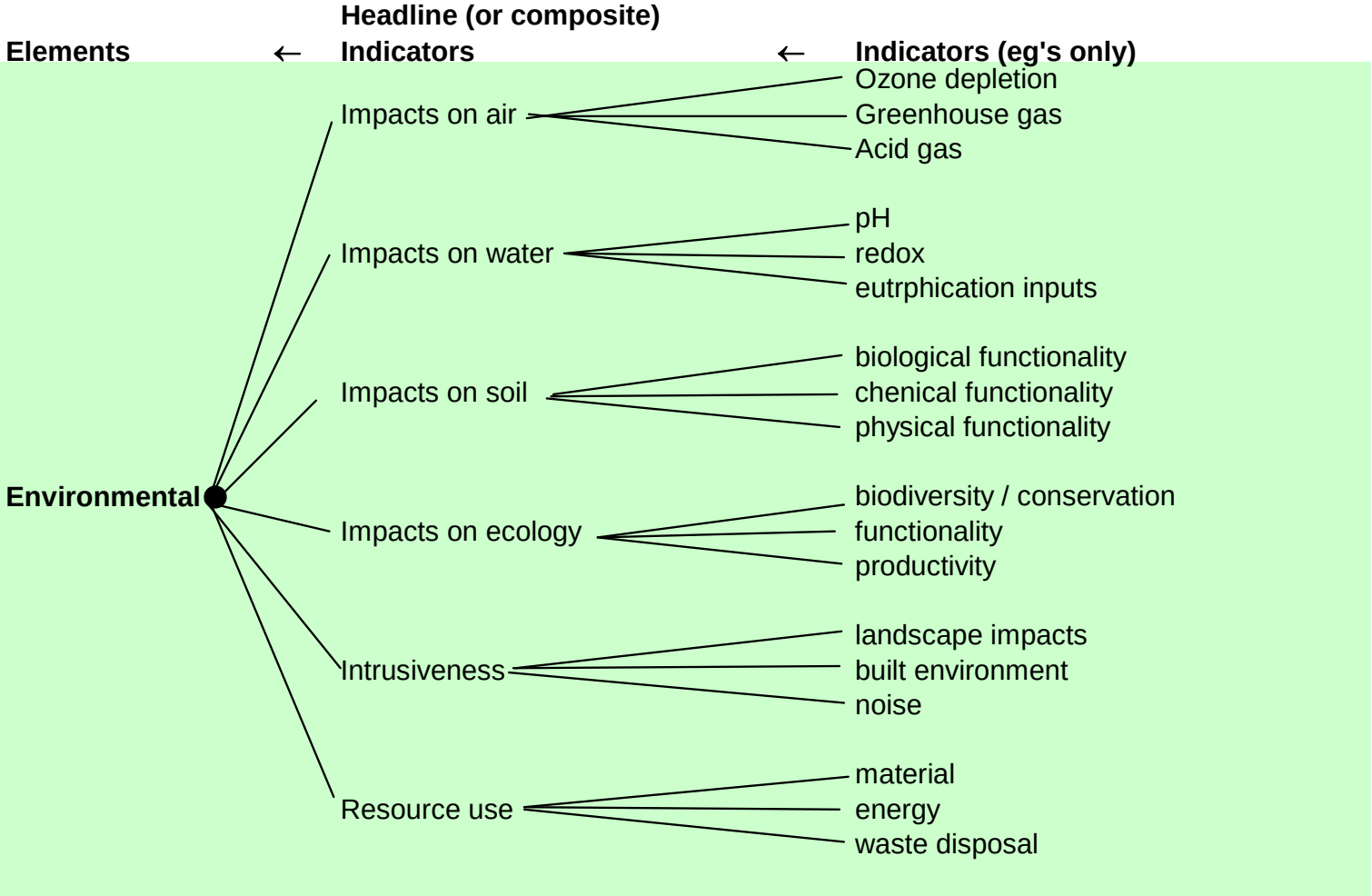
Or:



Indicator hierarchy:

Evidence → Individual → "Headline" → Elements → Overall

For example:

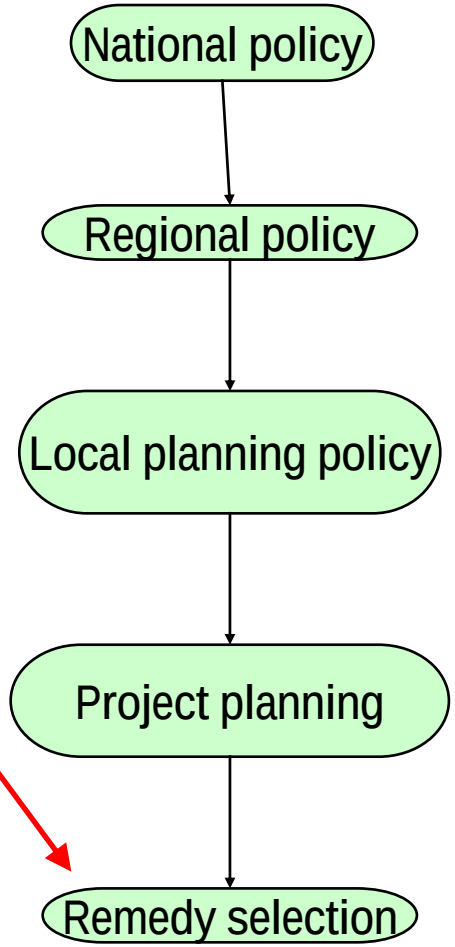

Elements
←
Headline (or composite) Indicators
←
Indicators (eg's only)
Environmental
Impacts on air
Ozone depletion
Greenhouse gas
Acid gas
Impacts on water
pH
redox
eutrphication inputs
Impacts on soil
biological functionality
chenical functionality
physical functionality
Impacts on ecology
biodiversity / conservation
functionality
productivity
Intrusiveness
landscape impacts
built environment
noise
Resource use
material
energy
waste disposal

European Soil Framework Directive

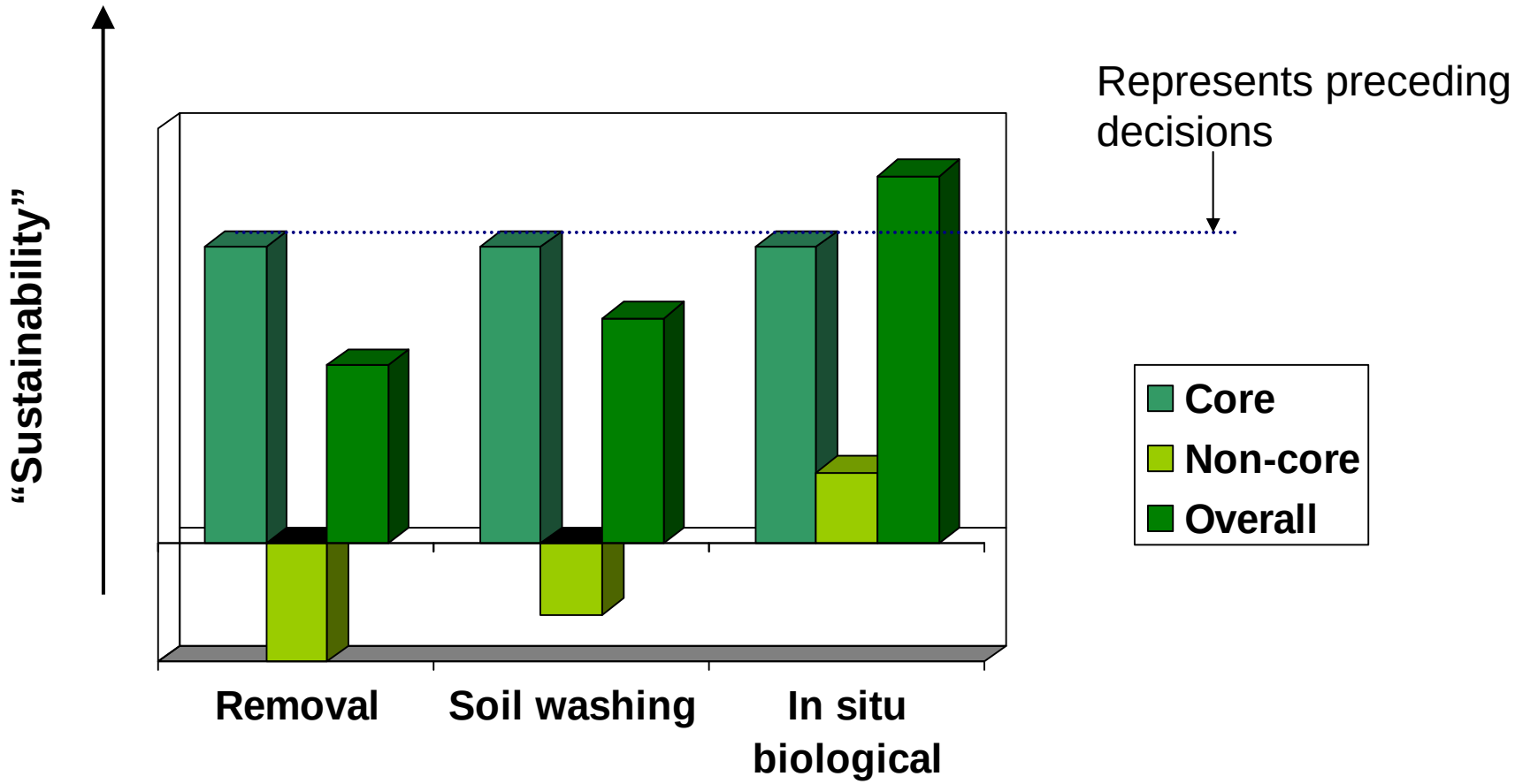
- Definition of remediation in the November 2008 draft text:
  - “Remediation shall consist of *sustainable* actions on the soil aimed at the removal, control, containment, reduction of contaminants, natural recovery or any other appropriate means, so that the contaminated site, taking account of its current use or approved future use, no longer poses any significant risk to human health or the environment”.

Sustainable Remediation?

- Is all remediation sustainable?
- Is it sustainable to use large amounts of fossil fuel to remove a small amount of TPH from a site?
- Are some remediation methods better than others for a particular site?
- Many decisions affect CLM sustainability before remedy selection, but should we still opt for “sustainable remediation?
- See www.claire.co.uk/surfuk



Different remedial approaches to a problem may have different "sustainability"



Qualitative vs. Quantitative

Qualitative

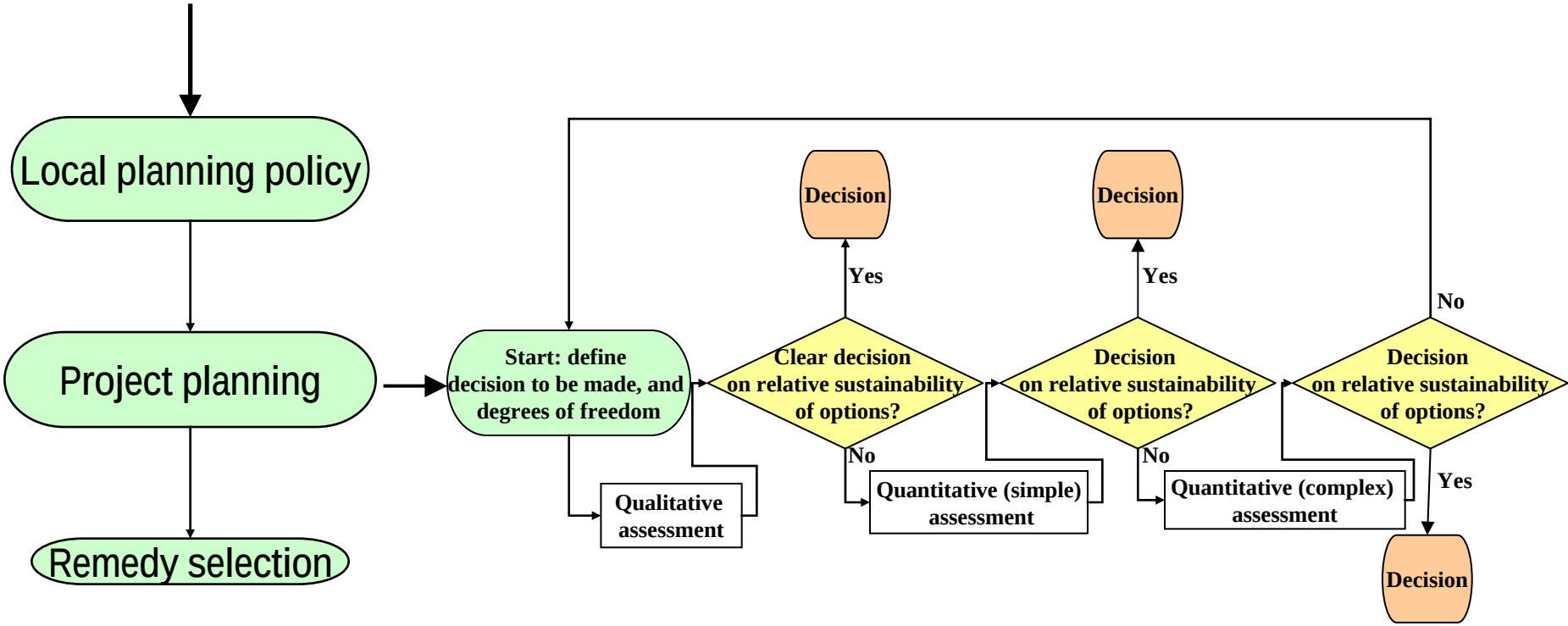
- Broad in scope (many indicators)
- More "involving" (especially for lay audiences)
- Transparent route from evidence through evaluation
- "Soft" information
- Policy, planning and participatory applications
- May be cheaper to carry out

Quantitative

- Narrow in scope (fewer indicators)
- More "excluding"
- Less transparent
- Seen as "hard" information
- Corporate applications: e.g. financial and carbon reporting
- May be a more expensive assessment

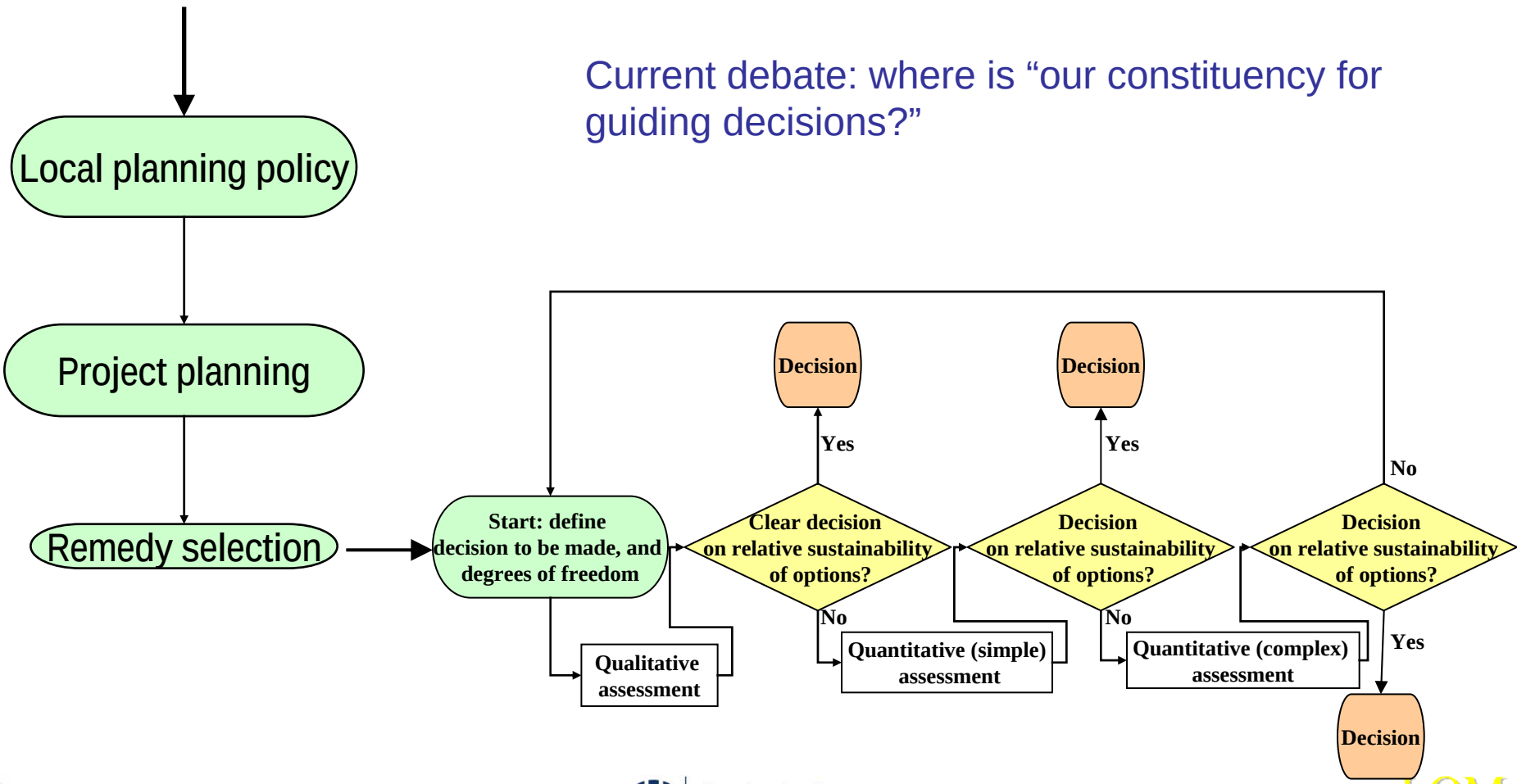
Suggest a tiered approach to maximise effectiveness

Components of SURF-UK Sustainable Remediation Framework



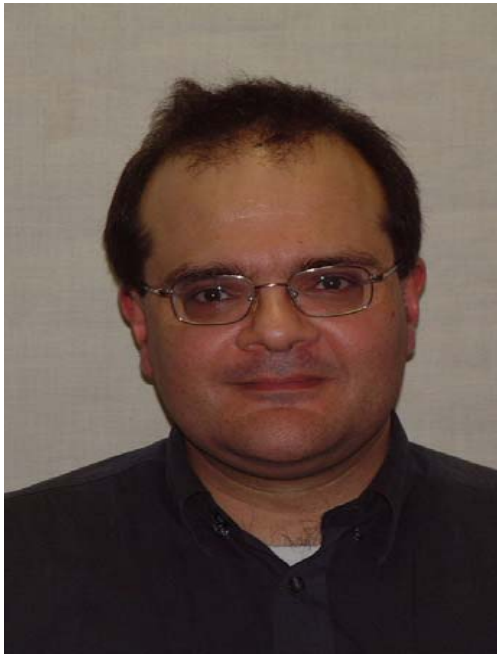
Components of SURF-UK Sustainable Remediation Framework

Current debate: where is “our constituency for guiding decisions?”



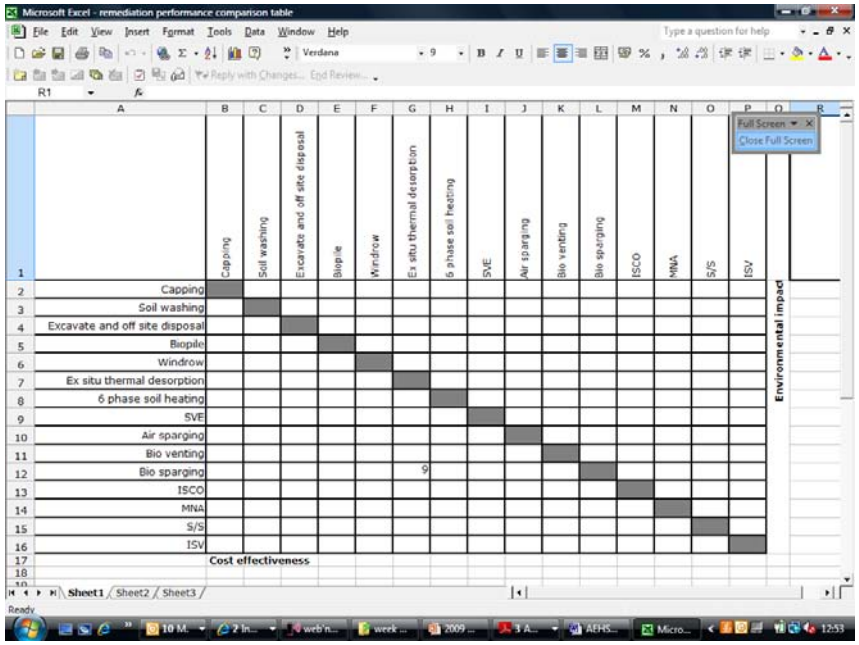
Professor Paul Nathanail CGeol SILC

- Paul is Professor of Engineering Geology at the University of Nottingham (www.nottingham.ac.uk) and Managing Director of Land Quality Management Ltd (www.lqm.co.uk).
- Research, teaching and consultancy interests span the spectrum of risk based contaminated land management and sustainable urban regeneration.
- Paul is involved in a number of professional and industrial fora.
  - Chairs, IAEG Commission C20 on Risk Based Land Management.
  - Specialist in Land Condition (www.silc.org.uk) and Chartered Geologist, represents the Geological Society on the SILC professional and technical panel.
  - Member, UK Health Protection Agency Contaminated Land Risk Advisory Forum and IPMNet's steering committee.
  - Director of CABERNET (www.cabernet.org.uk): Europe's sustainable brownfield regeneration network.



Pairwise comparison

- Compare all technically feasible shortlisted remedial options against each other for all relevant dimensions
- I am currently working on …
  - Social acceptability
  - Cost effectiveness
  - Environmental impact
  - Ease of verifications



Microsoft Excel - remediation performance comparison table

	Capping	Soil washing	Excavate and off site disposal	Biopile	Windrow	Ex situ thermal desorption	6 phase soil heating	SVE	Air sparging	Bio venting	Bio sparging	ISCO	MNA	S/S	ISV	Environmental impact
Capping																
Soil washing																
Excavate and off site disposal																
Biopile																
Windrow																
Ex situ thermal desorption																
6 phase soil heating																
SVE																
Air sparging																
Bio venting																
Bio sparging						9										
ISCO																
MNA																
S/S																
ISV																
Cost effectiveness																

Pairwise comparison of technically feasible remedial options

- Construct matrix of technically feasible remedial options
- Copy the matrix
- Matrix is asymmetrical: different dimensions are compared in each half;
- ‘Play’ each option against all the others for each of the 4 dimensions
- Decide for each dimension whether option A is *better* or *worse* than option B
- Calculate Consistency Ratio (CR)
- If CR<0.10
- If CR>0.10 then the scores are not consistent

A simple example

- A gasoline (petrol) spill has resulted in a BTEX plume in groundwater in a sand & gravel aquifer. The water table is at 3m (ca 10ft) below ground level; free product has been recovered.
- Technically feasible solutions include:

Feasible options

- Air sparging + SVE
- MNA
- Biosparging

Selection criteria

- Cost effectiveness
  - Volume to be treated
  - logistics
- Social acceptability
- Environmental impact
  - Carbon footprint
  - Wider environmental ‘value’
- Ease of verification

Shallow BTEX dissolved phase plume in sand and gravel aquifer

	A	B	C
A		A is 1/3 as acceptable as B	A is 1/9 as acceptable as C
B	B is 3* cost effective than A		B is 1/3 as acceptable as C
C	C is 9* cost effective than A	C is 3* cost effective than B	

Social acceptability

Cost effectiveness

illustration
scores can only be
1/9, 1/7, 1/5, 1/3, 1, 3, 5, 7, 9

File Edit View Insert Format Tools Data Window Help

	Air sparging	Bio sparging	MNA
Air sparging		"1/5	"1/5
Bio sparging	3		"1/3
MNA	7	5	

cost effectiveness

social acceptability

	Air sparging	Bio sparging	MNA
Air sparging		3	3
Bio sparging	5		3
MNA	7	5	

environmental impact

ease of verification

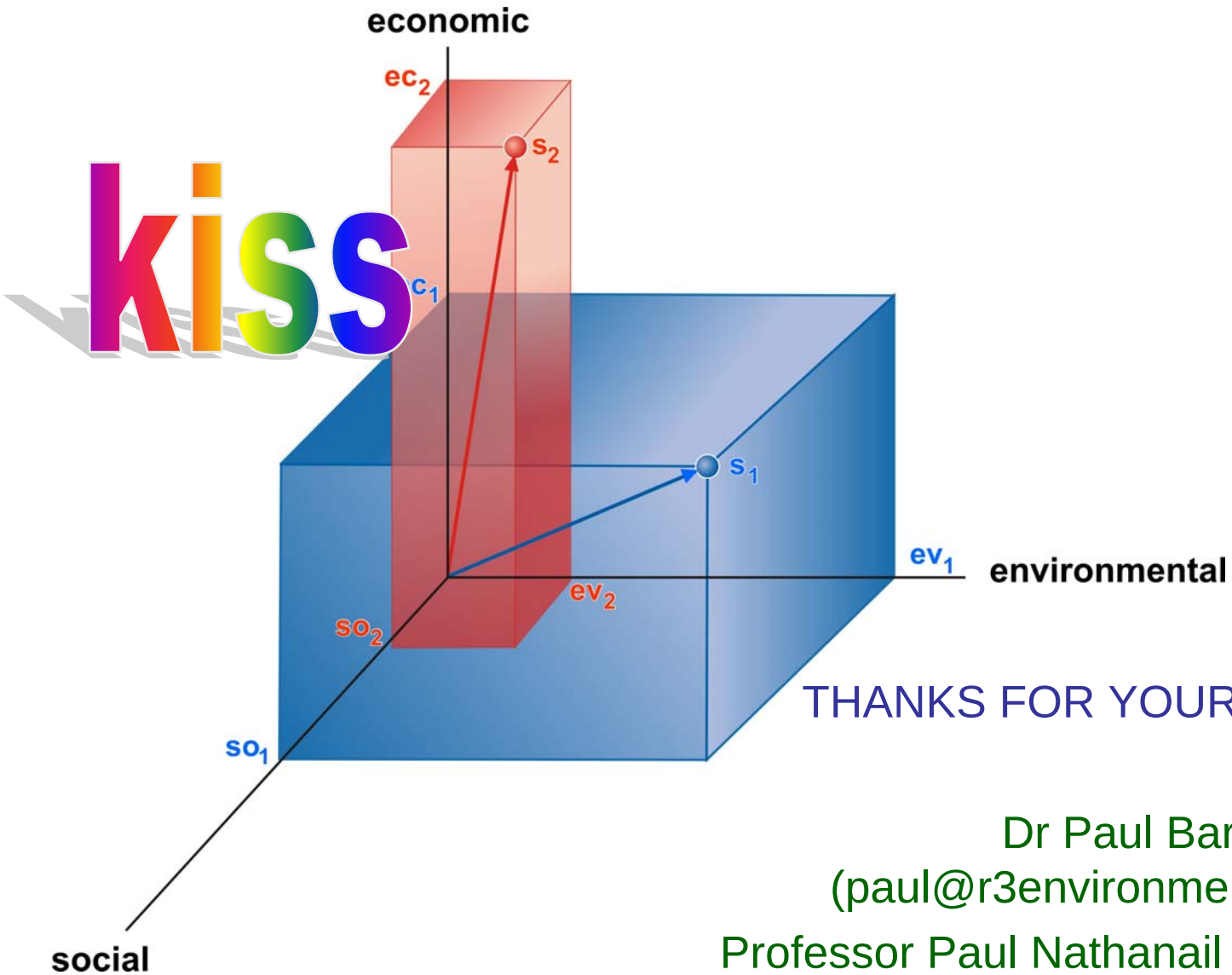
Full Screen
Close Full Screen

Results of a simulated scoring workshop with Masters delegates (from full time consultancy and regulatory backgrounds)

RESULTS

- Cost effectiveness: MNA, biosparge, air sparge
- Social acceptability: MNA, biosparge, air sparge
- Environmental impact: MNA, biosparge, air sparge
- Ease of verification: Air sparge, biosparge, MNA

- So the ‘winner’ is MNA in this particular case with these participants



THANKS FOR YOUR ATTENTION

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