1. Risk as Politics
2. The Limits to Risk Analysis
3. Precaution and Rigour
4. Engagement and Politics
5. Practical Implications for Communication

Risk and Evolution of Technology
Economics, history, social science:
Show path-dependent 'lock-in' to poor choices

VHS and Betamax
... Windows software...

Narrow Gauge Railways
... rail and road ...

QWERTY keyboards
... light water reactors ...

Risk and the Evolution of Technology
Technology is a wonderful thing!
– many different pathways …
– fertile with creativity and choice …
Technology is a wonderful thing!
– many different pathways …
– fertile with creativity and choice …

not all possibilities can be fully realised in globalised markets
eg: centralised thermal power / distributed renewable energy
  industrial GM agriculture / locally marketed low-input farming
  chlorinated plastics / recycled materials and energy
  private fossil-fuel cars / electric public transport
  IP-intensive medicine / community-based public health

outcomes driven by necessity, chance and the exercise of power

debates over ‘risk’ conceal a “hidden politics of technology”
‘Baby-talk’ on Innovation and Risk

"[we need] more pro innovation policies in the European Union…"
UK Chancellor, Gordon Brown, 26 January 2004

"[there is] an anti-technology culture in the UK, a pro-technology culture must be created…"
UK Council for Science and Technology, February 2000

No distinctions … no alternatives … no politics … no choice! denies the ‘genius of technology’

Risk and the Politics of ‘Sound Science’

"… this government’s approach is to make decisions on GM crops on the basis of sound science."
UK Prime Minister, Tony Blair, House of Commons, 10 November 2003

Science as a substitute for politics
Power denies role for contending interests, values, choices…

The Limits to ‘Sound Scientific’ Risk Assessment

Quantitative risk assessment appears precise, but is sensitive to framing

Risk as ‘externality’ (1998 c/kWh)
The Limits to ‘Sound Scientific’ Risk Assessment

Quantitative risk assessment appears precise, but is sensitive to framing.

- **coal**
  - Minimum
  - Maximum
  - Median

- **coal**, **oil**, and **gas**
  - Minimum
  - Maximum
  - Median

After Sundqvist et al., 2005.
The Limits to ‘Sound Scientific’ Risk Assessment

Quantitative risk assessment appears precise, but is sensitive to framing

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Risk Value</th>
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<tr>
<td>Coal</td>
<td>36</td>
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<tr>
<td>Oil</td>
<td>20</td>
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<tr>
<td>Gas</td>
<td>31</td>
</tr>
<tr>
<td>Nuclear</td>
<td>21</td>
</tr>
<tr>
<td>Hydro</td>
<td>16</td>
</tr>
</tbody>
</table>

RISK 1998 c/kWh

The Nature of ‘Framing’

Some dimensions of ‘framing’ in risk assessment

- setting agendas
- defining problems
- characterising options
- posing questions
- prioritising issues
- formulating criteria
- deciding context
- setting baselines
- drawing boundaries
- discounting time
- choosing methods
- including disciplines
- handling uncertainties
- recruiting expertise
- commissioning research
- constituting ‘proof’
- exploring sensitivities
- interpreting results

Example: Nuclear addressed in terms of climate change / security / sustainability

All analysis requires framing … all framing involves value judgements

‘Sound science’ and expertise give different answers to different questions

… we should be as rigorous about validating the questions as the answers

The Limits to Narrow Risk Assessment

Knowledge about outcomes

- problematic
- not problematic

Knowledge about probabilities

RISK
- engineering failures
- known epidemics
- transport safety
- flood (normal conditions)

AMBIGUITY
- “apples and oranges”
- landscape / emissions / safety
- interests, language, meaning

UNCERTAINTY
- ‘human element’
- climate change impacts
- assessed chemicals
- novel pathogens

IGNORANCE
- surprises like: BSE, CFCs
- endocrine disruption
- unknown mechanisms

Risk assessment limits are practical, methodological and theoretical

Arrow’s Nobel Prize shows ‘sound scientific’ policy is an oxymoron!
Precaution is about rigour under uncertainty, ambiguity, ignorance. Churchill: science should be “on tap not on top”.

Precautionary Tools for Appraising Incertitude

- Precaution means broadening the inputs to appraisal: methods, possibilities, options, issues, assumptions, perspectives.
Precaution: communicating beyond ‘the principle’

"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”

Principle 15, 1992 Rio Declaration

Like risk assessment, precaution is an incomplete ‘decision rule’
threat? seriousness? irreversibility? full scientific certainty? cost-effective?

Prompts unfavourable comparison with ‘sound scientific’ approaches (eg: risk, cost-benefit, decision, life cycle, environment impact analysis)

Major international political tensions: Kyoto, WTO, GM, Chemicals

In terms of communication, precaution and risk assessment in same boat

Analysis and Communication

Traditional Idea

Emerging Picture

HAZARD IDENTIFICATION

sound science

scientific research

RISK ASSESSMENT

comparative risk analysis

expert deliberation

RISK EVALUATION

rational analysis

cost benefit assessment

prescriptive recommendation

administrative decision

regulatory economics

decision analysis

policy science

RISK MANAGEMENT

policy implementation

social science

RISK COMMUNICATION

Analysis and Communication
Traditional Idea Emerging Picture

HAZARD IDENTIFICATION
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prescriptive recommendation
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Analysis and Communication
Rigid Decision Rules Broad-based Process

HAZARD IDENTIFICATION
RISK ASSESSMENT
RISK EVALUATION
prescriptive recommendation
RISK MANAGEMENT
RISK COMMUNICATION

Analysis and Communication

sound science?
scientific research
comparative risk analysis
expert deliberation

deliberation?
cost benefit assessment
administrative decision?
regulatory economics
decision analysis
policy science

Analysis and Communication

where there are threats of serious or irreversible damage lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation

Concrete implications
• public engagement in science
• strategic view of alternatives
• more humility on science

preferences for an extended scope of appraisal
• be pro-active about power

not bans for particular technologies, let alone technologies in general

Analysis and Communication

politics and communication
social science
political science
social psychology

Analysis and Communication

precautionary principle

concrete implications
• extend scope of appraisal
• more humility on science
• be pro-active about power
• deliberate over proof
• strategic view of alternatives
• public engagement in science

relevant also to risk appraisal

NOT bans for particular technologies, let alone technologies in general
Precaution as Rigour in Appraisal

extend scope additive, cumulative, synergistic effects; life cycles, compliance
real world effects of CFCs, MTBE, PCBs as "closed systems"

be humble on science sensitivities & proxies: mobility, persistence, bioaccumulation
omission of persistence in organochlorines, MTBE, CFCs

be active in research prioritise open monitoring & surveillance & targeted experiment
neglected: TBT, BSE; no monitoring: asbestos, benzene, PCBs

deliberate over argument levels of proof, responsibility for analysis, burden of persuasion
Swann committee on antimicrobials, 1967; later ignored

view alternative options pros, cons, justifications for range of options & substitutes
ALARA, BAT, BPM - licensing radiation, fisheries, acid rain

transdisciplinary learning collect all relevant knowledge, beyond the "usual suspects"
MTBE / engineers; BSE / vets

engagement in appraisal provides independence on interests and robustness on values
BSE, benzene, DES, asbestos, acid rain, fisheries

Normative Democratic
• about process: equity, inclusion, empowerment
even if "ineffective" or "inefficient" according to incumbent interests

Instrumental
• about narrow interests: trust, credibility, acceptance, "sedation"
(often justified and blame management in decision making)

Substantive
• about broad consequences: low harm, high benefit, sustainability, precaution
(provides rigour on framing assumptions as well as evidence and analysis)

Communication, Engagement and Politics

Contrasting pressures and rationales
(cf. Fiorino, US NRC)

Normative Democratic
the 'right thing to do' in a democracy

Instrumental
expedient means to some particular end

Substantive
improves general 'robustness' of policy advice

More broad-based 'precautionary appraisal' is a substantive reason for engagement

‘Opening Up’ Risk and Technology Policy

Conventional appraisal: ‘narrow’ inputs and ‘closed’ outputs to policy

For example:
"sound science dictates……GM is acceptable"…nuclear is best"…this plant is safe"…ban this chemical"

Conventional policy appraisal aims at 'closing down' decisions

‘Opening Up’ outputs to policy improves robustness and accountability

inputs to appraisal draw on broader precautionary approaches
outputs to policy delivered as plural and conditional advice

true both of analytic and participatory approaches: eg: consensus, conference

Opening up outputs to policy improves robustness and accountability

inputs to appraisal draw on broader precautionary approaches
outputs to policy delivered as plural and conditional advice

rigour on questions, values and interests as well as evidence and analysis
many practical methods: eg: sensitivities, scenarios, maps, minority views
mapping scientific appraisals of GM crops
(MCM study for Unilever ‘Round Table’, 1999)

organic
low input
conventional
GM crops

risk as ‘multi-criteria performance’
Broadening & Opening Appraisal: a practical example

mapping scientific appraisals of GM crops
(MCM study for Unilever ‘Round Table’, 1999)
(c.f. overlapping uncertainties, ambiguous prescriptions, conditionality of organic / GM)

organic low input conventional GM crops

high risk low risk

risk as ‘multi-criteria performance’

Broadening & Opening Appraisal: including citizens

Mean intervals:

17 Specialists
8 BC1 Men

- clear underlying picture of convergence
- picture broadly sustained across six different specialist groupings
- remarkable similarity to citizen panel appraisals (eg: men’s BC1 Panel)

Conclusions: communicating the real politics of risk

Evolutionary insights apply to technology and institutions as well as to risk
Open technological futures are subject to power and so a matter of politics

Language of ‘sound science’ in risk communication denies this reality
Undermines rigorous science and democratic accountability alike

Broad-based precautionary appraisal simply recognises this reality
Addresses uncertainty, ambiguity and ignorance as well as risk

Public engagement not about ‘education’, ‘trust’ or ‘political correctness’

Rigour in appraisal of values and interests as well as data and analysis

There are many practical ways to implement this in policy making

‘Opening up’ engagement, ‘mapping’ analysis, ‘plural’ policy advice

Rare chance to address both scientific rigour and democratic accountability
Andrew Stirling is a senior fellow and senior lecturer at Science and Technology Policy Research (SPRU) at the University of Sussex. Stirling holds a master’s degree in archaeology and social anthropology from Edinburgh and a D.Phil. in science and technology policy from the University of Sussex. His research focuses on risk and the dynamics of technology choice, critical policy analysis, ecological economics, the precautionary principle, risk and uncertainty analysis, decision analysis, multi-criteria mapping, technology policy, citizen participation, sustainability, and technological diversity and resilience. Stirling has published dozens of papers and monographs in scholarly journals and three books on risk research, energy policy, ethics, and the precautionary principle as applied to disparate subjects ranging from genetically modified crops to regulation of the electricity supply industry. He has served on a variety of policy advisory bodies, including the European Commission’s Energy Policy Consultative Committee, the UK Advisory Committee on Toxic Substances and Genetic Modification Science Review Panel, the European Commission’s Expert Group on Science and Governance and the Science Advisory Council of the UK Department of Environment Food and Rural Affairs. Stirling has also worked as a disarmament activist and board member for Greenpeace International.