The Role of Science within the Rule of Law
• Housekeeping
• Definitions
• The roles of **Laws**
• The roles of **Science in Law**
• Difficulties when **Science meets Law**
• Lessons from recent court cases
• Responses to Managerial risks
• The future
Supervisors at the University of Bristol
Jo Gottsmann, Willy Aspinall, (School of Earth Sciences)
Ryerson Christie (School of Sociology, Politics & International Studies)

Funding
VUELCO a project financed by the European Commission under the 7th Framework Programme for Research & Technological Development
Definitions

Risk = Hazard + Exposure + Vulnerability
HAZARD

Definitions

Temporal
- When?
- Duration?

Physical
- Intensity?

Spatial
- Where from?
- Where to?
Definitions

When?
Duration?
Intensity?
Where from?
Where to?

Probability
Vulnerability
Exposure
Likely adverse consequences
Risk Estimation
Risk Assessment

Adapted from Renn (2008) Risk Governance, Earthscan, UK & USA
Definitions

Societal risks

Managerial risks
• Institutional risks – Entities
• Professional risks - Individuals
Definitions

Standard Equivocality

The absence of commonly recognised standards (norms) capable of guiding, measuring and evolving acceptable practice

Rothstein 2002; Hood 1986
The link between Societal and Managerial Risks in the context of volcanic hazards

<table>
<thead>
<tr>
<th></th>
<th><strong>Societal risks</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hazard</strong></td>
<td>A wide range of scenarios including ash, lava, lahars, pyroclastic flows etc. that represent volcanic hazards</td>
</tr>
<tr>
<td><strong>Exposure</strong></td>
<td>People &amp; assets within the spatial parameters of the hazard in question.</td>
</tr>
<tr>
<td><strong>Vulnerability</strong></td>
<td>The susceptibility of the exposed people/assets to the physical parameters of the hazard in question and the resulting consequences (i.e. death, injury or damage).</td>
</tr>
</tbody>
</table>
The link between Societal and Managerial Risks in the context of volcanic hazards

<table>
<thead>
<tr>
<th></th>
<th>Managerial risks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hazard</strong></td>
<td>The governance of the <strong>Societal risks</strong> of volcanic hazards</td>
</tr>
<tr>
<td><strong>Exposure</strong></td>
<td>Entities and individuals who are duty holders in law in respect of the governance of societal risks – in reach of the long arm of the law!</td>
</tr>
<tr>
<td><strong>Vulnerability</strong></td>
<td>Any situation which represents a failure to fulfil a societal risk duty of care (a non-compliance) and the consequences of non-compliance including, but not limited to, naming-and-shaming, public scrutiny and criminal &amp; civil law sanctions</td>
</tr>
</tbody>
</table>
Laws create the infrastructure of societal risk governance

- Duty Holders
  - Institutional risks
  - Existing entities
  - New entities
    - Duties of care owed in respect of Societal risks
  - Rights Holders

- Scrutiny venues/procedures
  - Civil claims & risk of compensation payments
  - Criminal prosecutions & risk of penal sanctions
  - Fatal accident enquiries & risk of factual findings

- Regulators
Constants

• Do not vary from case to case

• Issues of Law not Fact (but they may still be disputed)

• Duty holders (Exposure? Yes. Vulnerability? Depends!)

• Duties of care (often a function or a desired, qualified on cost/benefit, result/goal)

• Rights holders

• Regulators & their powers
Constants

Football analogy

• Playing field

• Position & dimensions of goal

• Players

• Rules of game

• Referee & red cards

NOT how to kick the ball or score a goal!
Laws create the infrastructure of societal risk governance

Duty Holders

Duties of care owed in respect of Societal risks

Institutional risks

Scrutiny venues/ procedures

Civil claims & risk of compensation payments

Criminal prosecutions & risk of penal sanctions

Fatal accident enquiries & risk of factual findings

Budayeva Kolyadenko Vilines
Garcés

L'Aquila Fernandez

Montserrat 1998 Raoul Island, NZ 2006

Actual practice to fulfil duties of care as influenced by acceptable current practice but subject to “standard equivocality”

Rights Holders

Regulators
Variables

- Vary from case to case
- Issues of Fact not Law
- Actual performance which is then measured against what was required in law – Was there legal compliance?
Variables

Football analogy

- Actual kicking of the ball
- What actually happened during the game?
- What was the final score?
- Court cases = Slow motion TV replays, in front of partisan onlookers and hindsight experts, to determine whether the ball went over the line and, if not, why not! – Was there legal compliance and, if not, why not?
Laws create the infrastructure of Societal risk governance

Societal risk governance should be based upon sound Science
Making Policy & Designing REGULATION

Expert judgement input possible to:
- Characterise the temporal, spatial and physical parameters of many hazards, thereby answering the basic questions of what, when, where and with what consequences
- Policy Impact Assessments

Policy

Legal regulation

Law-backed self-regulation

Self-regulation

Achieving REGULATORY Compliance

Expert judgement will:
- enable characterisation of the REGULATED hazard, and thereby
- contribute to characterisation of the risk and
- assist risk mitigation by identifying practicable, science-based risk mitigation options.

Duty holders

Handling Scrutiny of REGULATORY Compliance

Expert evidence will address what scientific "tool" should have been used, by whom, how, when and with what foreseeable consequences.

Actual practice:
- to achieve compliance to the standard required by regulation; or
- to preserve the value of the regulatory standard by preventing "free-riding"

Rights holders
Making Policy & Designing REGULATION

Expert judgement input possible to:
- Characterise the temporal, spatial and physical parameters of many hazards thereby answering the basic questions of what, when, where and with what consequences
- Policy Impact Assessments

Achieving REGULATORY Compliance

Expert judgement will:
- enable characterisation of the REGULATED hazard; and thereby
- contribute to characterisation of the risk and
- assist risk mitigation by identifying practicable, science-based risk mitigation options.

Handling Scrutiny of REGULATORY Compliance

Expert evidence will address what scientific "tool" should have been used, by whom, how, when and with what foreseeable consequences.

Actual practice:
- to achieve compliance to the standard required by regulation; or
- to preserve the value of the regulatory standard by preventing "free-riding"

© Bretton & Herwig 2014
Scientific input to:
- Characterise the temporal, spatial and physical parameters of hazards
- Answering the basic questions of what, when, where and with what consequences
- Policy Impact Assessments

*Expert Elicitation may assist if there are conflicting science inputs*

---

**Making Policy & Designing Regulation**

- **Decision makers**
  - **Proof**
  - **Burden of**
  - **Standard of**

---

**Policy makers & Politicians**

---

**Policy makers & Politicians**

---

**Not applicable**
- Political drivers - *Credit v Blame*
- Economic drivers - *Benefit v Cost*
Making Policy & Designing REGULATION

Expert judgement input possible to:
- Characterise the temporal, spatial and physical parameters of many hazards thereby answering the basic questions of what, when, where and with what consequences
- Policy Impact Assessment

Achieving REGULATORY Compliance

Expert judgement will:
- enable characterisation of the REGULATED hazard; and thereby
- contribute to characterisation of the risk and
- assist risk mitigation by identifying practicable, science-based risk mitigation options.

Handling Scrutiny of REGULATORY Compliance

Expert evidence will address what scientific "tool" should have been used, by whom, how, when and with what foreseeable consequences.

Actual practice:
- to achieve compliance to the standard required by regulation; or
- to preserve the value of the regulatory standard by preventing "free-riding"

© Bretton & Herwig 2014
Scientific input will:
- enable characterisation of the REGULATED hazard; and thereby
- contribute to characterisation of the risk and
- assist risk mitigation by identifying practicable, science-based risk mitigation options

*Expert Elicitation may assist if there are conflicting science inputs*

---

**Achieving Regulatory Compliance**

Duty holders → Decision makers

Proof

Duty holders

? Reasonably competent Duty holder

Burden of

Standard of
Making Policy & Designing REGULATION
Expert judgement input possible to:
- Characterise the temporal, spatial and physical parameters of many hazards thereby answering the basic questions of what, when, where and with what consequences
- Policy Impact Assessments

Achieving REGULATORY Compliance
Expert judgement will:
- enable characterisation of the REGULATED hazard; and thereby
- contribute to characterisation of the risk and
- assist risk mitigation by identifying practicable, science-based risk mitigation options.

Handling Scrutiny of REGULATORY Compliance
Expert evidence will address what scientific "tool" should have been used, by whom, how, when and with what foreseeable consequences.

Policy
Legal regulation
Law-backed self-regulation
Self-regulation
Duty holders
Actual practice:
- to achieve compliance to the standard required by regulation; or
- to preserve the value of the regulatory standard by preventing "free-riding"

Rights holders
© Bretton & Herwig 2014
Scientific expert evidence will address what scientific "tool" should have been used, by whom, how, when and with what foreseeable consequences.

Handling Scrutiny of Regulatory Compliance

Science and scientists as objects of scrutiny within a scrutiny process

Raises questions of: Fact Opinion Law
Proof

Criminal proceedings

Civil proceedings

Prosecution

Burden of

Claimant

Beyond all reasonable doubt

Are you sure that?

100%?

Standard of

Balance of probabilities

Is it more likely than not that?

> 50%

Deciders of fact

Lay magistrates
Judge alone
Jury
Judge & lay/expert assessors

Judge
Science as a *forensic tool* within a scrutiny process

**Drawing an inference about the proportion of a large consignment which contains something that is illegal. It is not practically feasible to inspect a whole consignment that contains something illegal. Ought the target proportion inspected be taken as being greater than a particular threshold?**

**Which of 2 competing propositions is true?**

**Uncertainty about whether the Defendant’s shoe, or some unknown shoe, is the source of a mark found at the scene of a crime.**
Cases in the context of a generalised legal infrastructure

Standard Equivocality

The absence of commonly recognised standards (norms) capable of guiding, measuring and evolving acceptable practice

Actual practice to fulfil duties of care as influenced by acceptable current practice
Standard Equivocality

Football analogy

• What is good play (Acceptable practice)?
• Who are good players (Who are competent experts)?
• Who are good players playing badly (Has a competent expert made an culpable error?)
• When and how can they be measured & verified?
• Can characteristics of good play (competency) be:
  • Recognised?
  • Taught?
  • Improved with coaching?
Responses to Managerial Risks

Get Better
- at Societal risk management

Get Smarter
- at Managerial risk management
  • Get out
  • Get defensive

Get a Lawyer
Responses to Managerial Risks – The Future

Get Better at Societal Risk Management

Volcano Observatory Best Practice Workshop (Sicily, 2013)
IAVCEI (COV8, Indonesia, 2014)
COST (Rome, 2014)
Questions
Cases in the context of a generalised legal infrastructure

Duty Holders

Duties of care owed in respect of Societal risks

Actual practice to fulfil duties of care as influenced by acceptable current practice

Rights Holders

Scrutiny venues/procedures

Civil claims & risk of compensation payments

Criminal prosecutions & risk of penal sanctions

Fatal accident enquiries & risk of factual findings

Budayeva Kolyadenko Vilnes

Garcés

L’Aquila Fernandez

Montserrat 1998 Raoul Island, NZ 2006

Regulators