Coping with Uncertainty: The Need for Integrating Management and Communcation

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Part 1:
Basic Features of Uncertainty

Risk and Uncertainty

Risk and Uncertainty: Conceptual Note I

- *Linear relationships*
  - Plausible connection between cause and effect
  - Symmetry between explanation and prediction
  - Lack of intervening variables
  - Stable context conditions
  - Normal distribution of aleatory elements in prediction
- *Complex relationships*
  - Cause-effect chain requires modeling (not obvious)
  - Many intervening variables and changing context conditions
  - Explanation ex post possible, prediction often fuzzy
  - Resolution by scientific investigations and scrutiny

Risk and Uncertainty: Conceptual Note II

- *Uncertainty (first order)*
  - Complexity cannot be fully resolved
  - Fuzzy combination of aleatory and epistemic uncertainty
  - Caused by data imprecision, model limits, and extrapolation methods (confidence intervals)
  - Quantitative estimates possible but not fully reliable
- *Uncertainty (second order)*
  - Cause-effect likely but neither proven nor quantifiable
  - Genuine stochastic relationships (do they exist?)
  - System boundaries (observation limits)
  - Non-knowledge (surprises, outliers, idiosyncracies)

Risk and Uncertainty: Conceptual Note III

- *Implication for uncertainty (first order)*
  - Tradeoffs between risk and benefits impossible to calculate, but numerical estimates are helpful
  - Need for advanced methods of uncertainty characterization
  - Need for **robust** risk management
- *Implication for uncertainty (second order)*
  - Concept of tradeoffs may be misleading
  - Need for qualitative characterization of knowledge boundaries
  - Focus on vulnerability of risk absorbing systems
  - Need for **resilient** risk management

Risk and Ambiguity: Conceptual Note IV

- *Interpretative ambiguity*
  - Not related to factual statements but to interpretation with respect to a value dimension (such as “adverse effect” or “safety”)
  - Variation due to different values or priorities on values
  - Need for discourse-based management (goal of common understanding)
- *Normative ambiguity*
  - Related to judgment about tolerability or acceptability
  - Variation due to legal context, level of aspired safety, security and quality of life, related tovalue clusters
  - Need for discourse-based management (goal of legitimate agreements)

Special Challenge: Systemic Risks

- Characteristics
  - Highly complex
  - Second order uncertainty (non-knowledge)
  - High interpretative and normative ambiguity
  - Open system boundaries (ripple effect)

- Problems
  - Limits of quantification
  - Plurality of risk assessment results and uncertainty characterization
  - System breakdown possible
  - Potential for high social mobilization

Implications for Management and Communication:

NEED FOR DIFFERENT RISK MANAGEMENT STRATEGIES

- dealing with routine, linear risks
- dealing with *complex* and moderately *uncertain* risks *(first* order uncertainty)
- dealing with highly *uncertain* risks (high degree of *second* order uncertainty)
- dealing with highly *ambiguous* risks (high degree of controversy)
- dealing with imminent dangers or crisis (need for fast responses)

RISK MANAGEMENT STRATEGIES (I): ROUTINE AND COMPLEXITY

Linear Risk Management

- Sufficient knowledge of key parameters
- Little complexity, clear causal knowledge
- Standard Assessment sufficient
- Risk-benefit analysis and risk-risk comparisons as basic tool for evaluation

Risk-Informed Management

- High complexity of causal risk models
- Low uncertainty or only first order uncertainty
- Expanded risk assessment / need for knowledge management tools
- Emphasis on robust risk management strategies, i.e. risk standards including safety factors and dealing with ranges of impacts
- Emphasis on close monitoring of outcomes

RISK MANAGEMENT STRATEGIES (II): COPING WITH UNCERTAINTY

Precaution-Based Management

- High second order uncertainty
- Adverse effects plausible but quantification not reliable
- Limits of knowledge are recognizable
- Characterization of uncertainty by non-statistical means
- Goal of risk management: avoidance of irreversible effects
- Instruments:
  - Negotiation between too little and too much precaution
  - classic: ALARA etc.
  - new: containment, diversification, monitoring; substitution

RISK MANAGEMENT STRATEGIES (III): COPING WITH AMBIGUITY

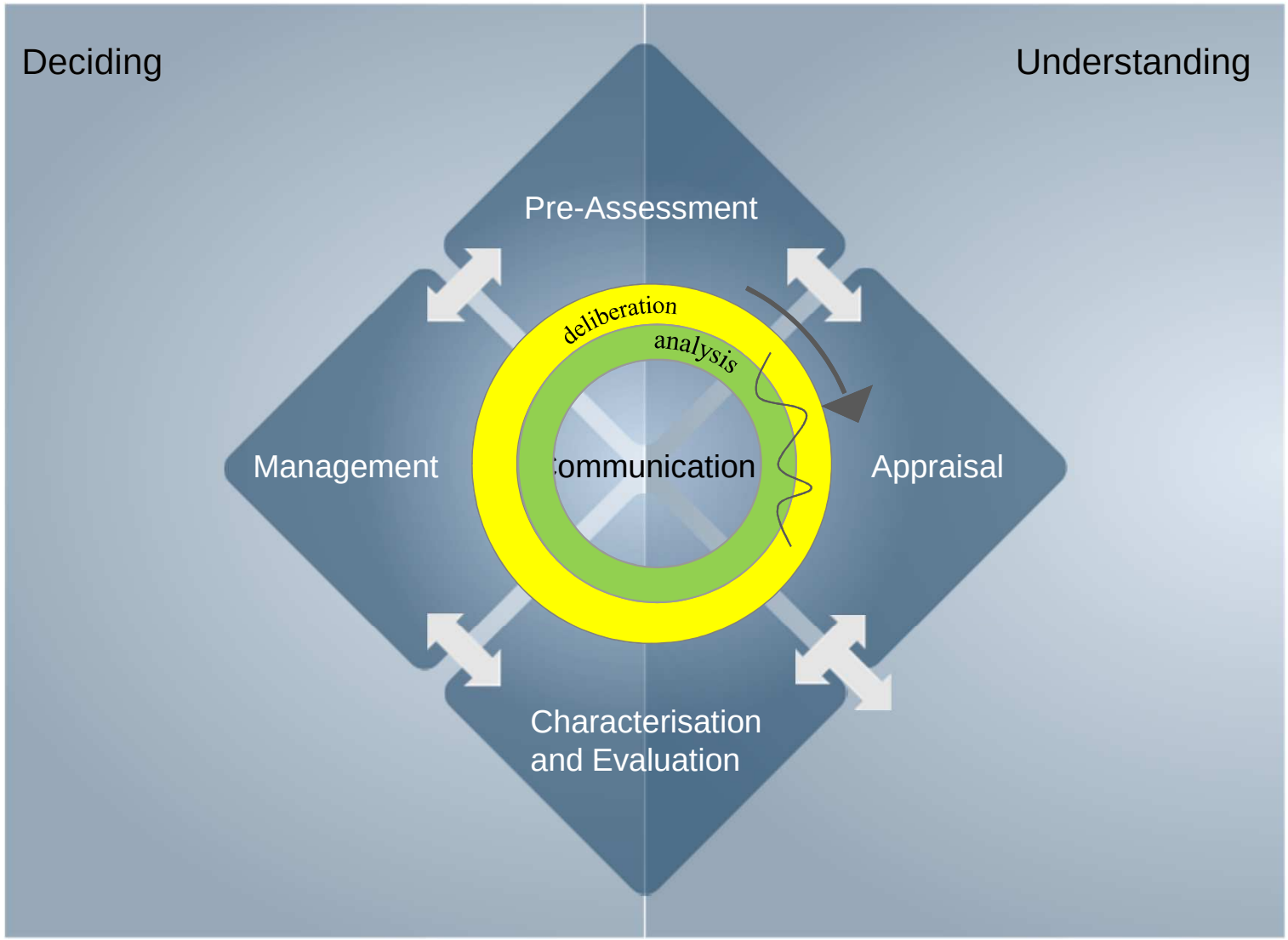
Discourse-Based Management

- High ambiguity
- Goal of risk management:
  - to find common understanding among all stakeholders (interpretative ambiguity)
  - to find legitimate procedures of making collectively binding decisions on acceptability and tolerability (normative ambiguity)
- Instruments:
  - stakeholder involvement
  - public debate
  - risk communication

Complementary Phase

Implications for Risk Communication and Stakeholder Involvement

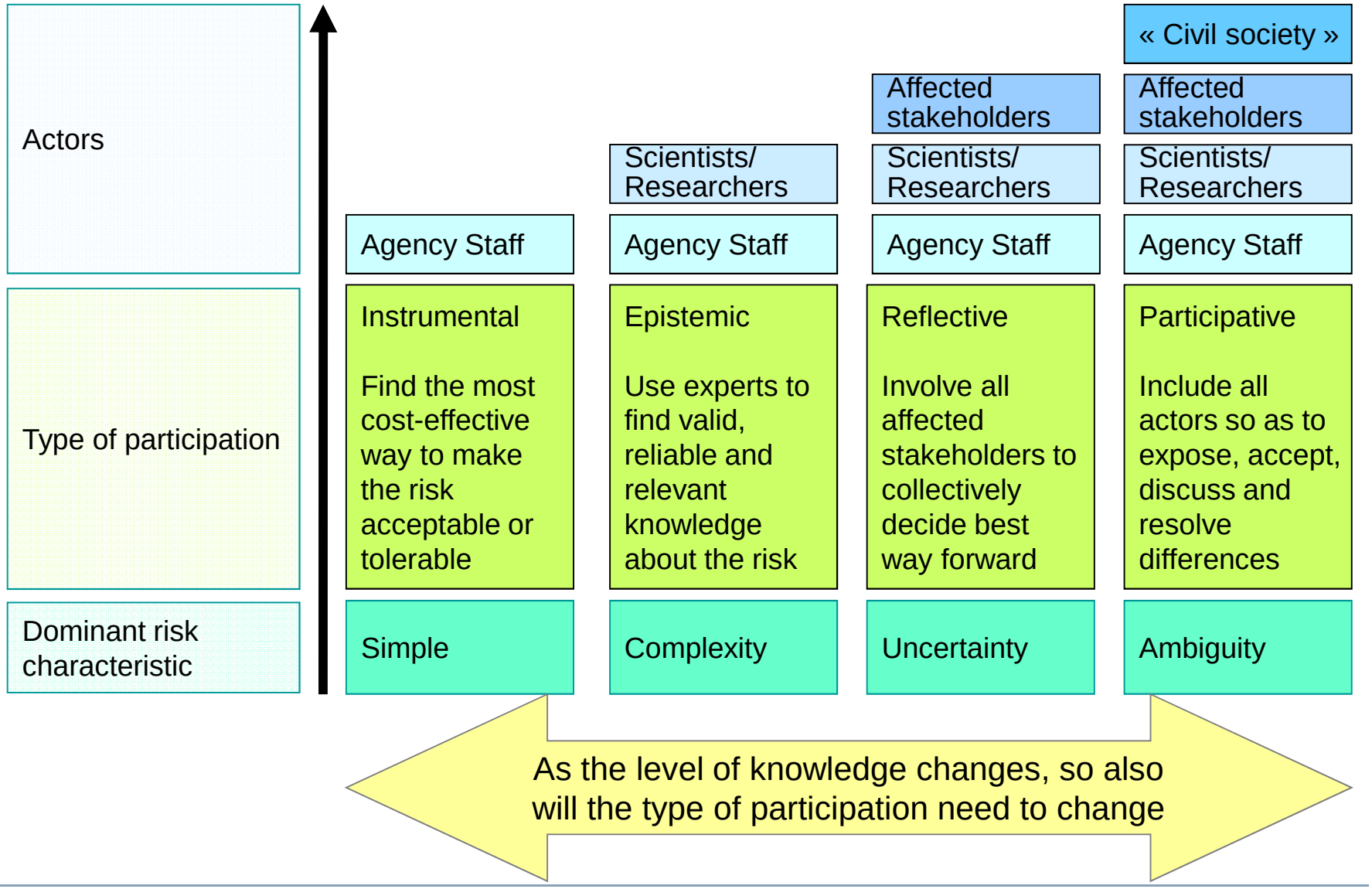
Risk Governance Process



Crucial Questions for Involvement

- ***Inclusion***
  - *Who:* stakeholders, scientists, public(s)
  - *What:* options, policies, scenarios, frames, preferences
  - *Scope:* multi-level governance (vertical and horizontal)
  - *Scale:* space, time period, future generations
- ***Closure***
  - *What counts:* acceptable evidence
  - *What is more convincing:* competition of arguments
  - *What option is selected:* decision making rule (consensus, compromise, voting)

STAKEHOLDER INVOLVEMENT



Part IV
Conclusions

Lessons for Risk Governance

Conclusions I

- **Problems in handling risk and uncertainty:**
  - Plural values and knowledge claims
  - Oscillation between relativist and positivist perspectives on risk and knowledge
  - Expert dissent on degree of complexity, uncertainty and ambiguity
  - Low degree of distinction between complexity, uncertainty (first and second order) and ambiguity
  - Social amplification and attenuation are attached to handling of complexity, uncertainty and ambiguity
  - Inadequate methods to deal with different clusters of complexity, uncertainty and ambiguity
- Emergence of systemic risk that load high on CUA cross national and sectoral boundaries (ripple effects)
- Need for an integrated risk management/communication approach

Conclusions II

- Four risk management regimes should be used to deal with these new risk challenges:
  - linear risk management: standard risk assessments
  - *risk-informed management:* expanded risk assessments; seeking expert consensus and epistemic clarification
  - *precaution-resilience-based management:* negotiated safety level under uncertainty; seeking stakeholder consensus and relying on containment and resilience
  - *discourse-based management:* value-based orientation; seeking more public input and stakeholder involvement for interpretative variability and normative controversy

QUOTE

- “What man desires is not knowledge but certainty.”
  Bertrand Russell

- Policy makers cannot produce certainty but can help people to develop coping mechanisms to deal prudently with the necessary uncertainty that is required for societies to progress