Information, adaptation and decision making in crisis response

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Quantitative PA: analytics, modeling & simulation

Theme: global challenges: climate, energy, water, security, health, development, etc.

Student influx: from 80 now (est’d) to 100 (2017)

New challenging curriculum; blended, case-based learning

Research and Education embedded in ‘The Hague’

Functioning Modeling & Simulation Lab for students and staff
Crisis Decision Making

Ill-defined goals and ill-structured tasks
Shifting and competing goals
Uncertainty, ambiguity and missing information
Dynamic and continually changing conditions
Action – feedback loops: real-time reactions to changed conditions, particularly also for non-effects

Time stress
High stakes
Multiple players
Organizational norms and goals (& narratives) as orientation
Combination of experienced decision makers, affected people, volunteers, ...
“Timely information can save lives... Aid organizations must recognize that accurate, timely information is a form of disaster response in its own right.”

- M. Niskala, Secretary-General of the IFRC, World Disasters Report 2005
INFORMATION NEEDS FOR DECISIONS IN THE FIELD?
IM in Complex and Natural Disasters: Challenges

**Natural disaster response:**
Fast, streamlined, automated production of standard products
Reduced the flexibility in tailoring to actual needs, or even lack of clarity about the needs
Access as driver of quality

**Complex disaster response:**
Information sensitivity and a lack of adequate procedures to handle this
Lowest common denominator in information product quality as only that information of which one is absolutely certain is being published
Sensitivity and barriers to sharing as driver of quality
What are the turning points in a disaster? The risk accelerators? They change throughout the disaster.

Jesper Lund, head of OCHA operations
wicked problems

- multiple stakeholders across spatio-temporal scales
- distributed decision-making
- diverging preferences with respect to solutions
- Preferences are endogenous and dynamically co-evolve with solutions
- problem formulation and problem solving are intertwined
- price of being wrong is very high
- contested knowledge and ambiguity (Dewulf et al. 2005)
A new decision aiding paradigm

Decision making under deep uncertainty

Exploratory modeling
Explore the consequences of the various presently irreducible uncertainties for decision-making using scenario-based techniques for the systematic exploration of a very large ensemble of plausible futures

Adaptive planning
Design plans that can be adapted over time in response to how the future actually unfolds
Fast and Simple models

A modelers fallacy: the more detailed the model, the more precise its results, therefore the more reliable its results

Consequence

- Ever increasing size of models
- Ever increasing runtimes (despite technological development)
- Ever more difficult to assess whether the model produces the right outputs for the right reason
Deep uncertainty

- Deep uncertainty is also known as Knightian uncertainty, uncertainty proper, or severe uncertainty
- Decision makers and stakeholders do not know or cannot agree on the outcomes of interest, the system under study, or future developments
- Decisions are often made over time in dynamic interaction with the system.
- Implication: set of plausible models of the system, set of outcomes of interest without a priori weighting, and sets of scenarios
- So, must accept that prediction cannot be done, and an ‘optimal policy’ cannot be found

Kwakkel et al. 2016, doi:10.1061/(ASCE)WR.1943-5452.0000626
From Predict and Act to Explore and Adapt

From prediction to exploration

Decision support for policy design

**Basic idea:** explore the consequences of the various unresolved uncertainties, identify differences that make a difference, iteratively reduce sensitivity of plans to these differences, and only then (perhaps) discuss their probabilities

From acting to adapting

Frameworks of design concepts for adaptive policies

**Basic idea:** design a plan from the outset to be adapted over time in response to how the future unfolds, focus on robustness rather than optimality

Adaptation pathway map

Transfer station to new policy action

Adaptation Tipping Point of a policy action (Terminal)

Policy action effective
In 2000 there were 41 significant attacks on aid workers recorded across the globe. By 2014, it had risen to 190. In those 15 years, over 3,000 aid workers have been killed, injured or kidnapped.
From Tracking to protection

Support collective decision-making and coordination in disasters.

Purpose

(i) identifying threats and issuing real-time warnings;
(ii) improving coordination of responders by secure information sharing and live decision support;
(iii) providing logistics functionalities such as navigation, routing, scheduling and inventory management.
Selected Readings


Thank you

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