EXPECTING THE UNEXPECTED - COPING WITH CRISIS

Preface to Plenary IV "Crisis Science: Anticipatory, Real-Time, and Preventive"

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ABSTRACT

In this paper we identify the different ways of reacting to the impacts of disasters. We stress the advantage of pro-actively fighting disasters by means of appropriate preparation and intervention. Two of the most important support strategies are Anticipation and Crisis Science used in combination and supported by Information and Communication Technologies (ICT). Based on the 5 phases of Disaster Management we identify essential activities to be performed before, during and after a disaster and point to the necessary application of Crisis Science.

Keywords: Disaster Management, Crisis Science, Anticipation, Intervention, resilience, ICT, phases, systems thinking

REACTING TO CRISIS

Many factors (larger population, greater dependance on technology, more human interference with the equilibrium of natural systems, resulting in climatic change, ...) seemingly increase in the frequency and the severity of disasters. Some of the disasters even endanger the foundations of parts of our society and the media coverage exaggerates this impression.

Experience tells us that no matter what precautions and safety approaches we take we will always encounter unexpected disasters causing damage.

In general animals and humans have six basic strategies for coping with threats (fig. 1), but not all of them may be feasible/available in a specific situation:

- Flight/run away: *run to safety*
- Fight/intervene: *intervene in order to prevent or mitigate the disaster*
- Freeze: *"play dead"*
- Submit/sustain/endure: *accept the situation without any resistance*
- Ignore/deny: *pretend/behave as if nothing has happened or interpret the disaster as a lucky event*
- avoid: *try to prevent the disaster before it happens*

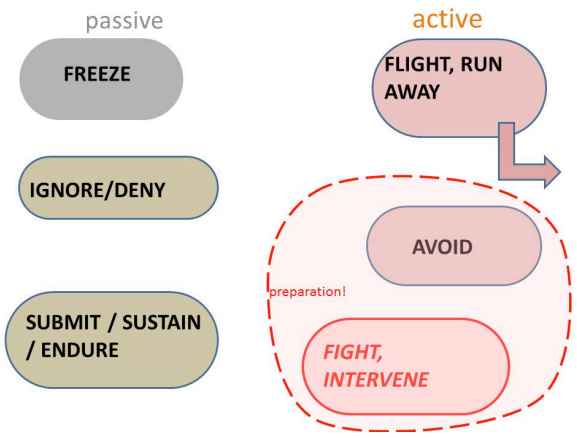

Figure 1. Fundamental (Re-)Actions

Humans individually, as a group, or as a society aim at mitigating the effects of an actual disaster. In most cases this means taking an active response (see fig. 1) and to endeavoring to fight/intervene in a disaster situation. The basic and ultimate goal of this behavior is to ensure at least a minimally acceptable level of survival of the population together with its societal structure, infrastructure and environment.

Animals often show a different strategy (e.g. "playing dead") and try to preserve the future of their species, even by sacrificing individuals.

Meaningful and effective action against a disaster always entails planning and preparation in advance, even if planning ahead often involves a considerable amount of uncertainty with respect to the specific type of disaster, the time of occurrence, and its impact. Challenges when trying to fight a catastrophe concern human, technical, logistic and environmental problems. Many of the challenges posed for Disaster Management have been amply discussed in the literature:

- the emergence of unexpected situations, combination and interplay of unfavorable hazards ("Facing the Unexpected" (Tierney et al., 2001)),
- unexpected destruction or disablement of needed humans and material resources necessary for an intervention; planned for rescue personnel can have become victims themselves,
- communications and computers may be 'secondary drop-outs' due to lack of electricity or personnel,
- large differences in time behavior of the evolvement of the disaster (slow versus fast onset (Mrotzek, 2009; Syvitski, 2009)),
- unknown or underestimated size of the disaster,

- discounting of the future by not considering 'long tails' and 'black swans' (Taleb, 2012)),
- human short-sightedness with respect to taking precaution and making adequate preparations,
- unwillingness to invest in the cost of preparation, forgetting "an ounce of prevention is better than a pound of cure",
- lack of holistic thinking when planning an interventions,
- lack of availability of archived historical data and 'lessons learnt'

PHASES OF A DISASTER

We identify 5 phases of Disaster Management (fig. 2). An uniformly accepted terminology still seems to be missing (Tierney et al., 2001; Khan et al., 2008; McEntire, 2007; INSARAG (ed.), 2012; ISO, 2011).

The Actual Incident is the pivot point in the sequence of phases but sometimes it may be difficult to pin-point the actual starting point, especially for slow-onset disasters like global warming.

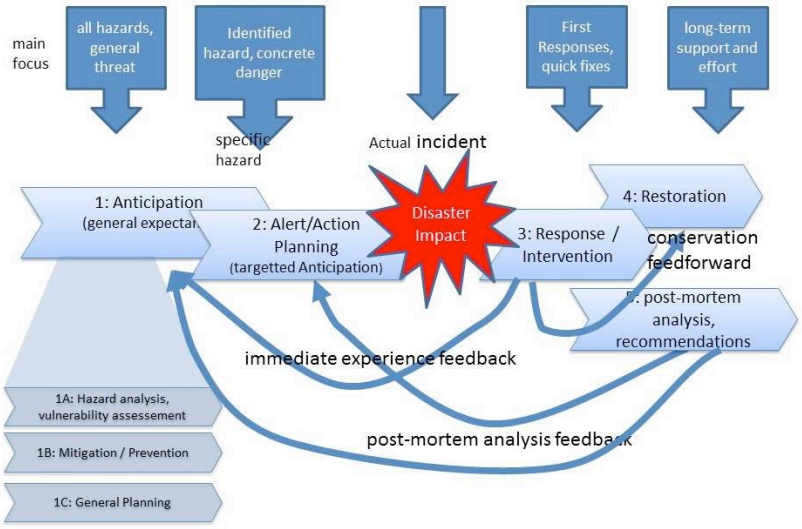

Figure 2. Disaster Phases and corresponding response processes

Fig. 2 shows the 5 phases of Disaster Management and important information flows. The main focus of each phase is written above the phase.

- **Anticipation** "general anticipation": This encompasses all activities which are undertaken before any specific hazard threatens (IFRC (ed.), 2007b,a; McEntire, 2007; Tierney et al., 2001; Poli, 2014; Rosen, 1985).
- **Alert / Action Planning** "targeted anticipation": Based on a concrete thread plans and strategies are refreshed and updated, advance warnings are issued, etc.
- **Response/Intervention** "action!": The primary concern is rescuing people and bringing the system into a temporarily stable state (’quick fixes’), in most cases with external help. The action plans of the preceding phases come to fruition.
- **Recovery/Restoration** "back to normal?": The often long-lasting Restoration Phase intends bringing the system back into a long-term acceptable state with respect to materials and emotions (Chroust et al., 2015). At the same time additional attempts are often made to reduce the vulnerability of the system (providing more antifragility) and also trying to improve maintainability.
- **Post-mortem Analysis and Recommendations** ("after the disaster is before the disaster"): This is the path to future improvement, especially to antifragility, by collecting, aggregating, analyzing, and applying lessons learnt and making recommendations for future Phases 1.

Additionally a considerable number of disasters trigger a *secondary disaster* (fig. 3) which sometimes even surpassing the threat of the first disaster

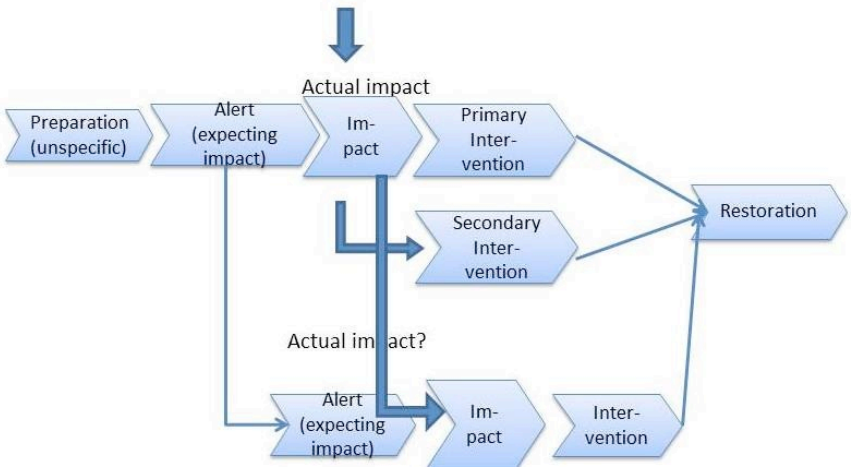

Figure 3. Phasing for Secondary Disasters

Key information flows are:

- from Intervention Phase to Restoration Phase (essential data needed for restoration) making restoration possible or easier
- from Intervention Phase to the next Anticipation Phase (lessons learnt with respect to the identification of type of disaster, improvement of planning for the next

intervention)

- from Post Mortem Phase to Anticipation Phase ("after the disaster is before the disaster") providing retrospective observations and "lessons learnt"
- from Post Mortem Phase to Preparation Phase ("lessons learnt" based on ex-post analysis)

DISASTER AND SCIENCE

Disasters are one-of-a-kind, but we must still look for similarities and powerful abstraction to allow scientific analysis and improved mitigation based on accumulation of actual experience and its scientific interpretation.

Science plays a key role in Disaster Management by collecting, analyzing, and providing data from past and current events. These data are used for providing visualization, computed scenarios and trajectories in order to support decision making, communication and logistics (Wood, 2013).

before the disaster/ anticipatory : We need Anticipation and systemic thinking in order to understand the relationship and cybernetic loops of the components in the affected system. This is the basis for appropriate responses (interventions) in order to achieve resilience in even emergent situations ("Facing the Unexpected" (Tierney et al., 2001; Singh, 2015)).

Anticipation provides greater understanding of the long-term effects resulting from our interventions in nature, human society, and environment, including potential misuse (Loewenstein, 2015).

during the disaster / real-time : Actual interventions (responses) during a disaster must holistically evaluate the total situation and establish priorities. They have to operate with uncertainty, extreme psychological pressure on victims and rescuers, severe time limits, and usually adverse environmental and infrastructural conditions. Data collection and recording is of great importance for planning and decision making, etc. This is also very important for post-mortem analysis (causal analysis), trace-back, and also for later restorations. It needs to be done in real-time because,

- information may get lost or be distorted when reconstructed during the post-mortem analysis,
- information can be useful and or even necessary for the restoration phase, e.g. pictures and data of the situation berfore andgat the time of disaster, e.g. before buildings completely collapse etc.

after the disaster / Restoration : Data collected in previous disaster phases are essential for reconstruction, be it 1:1 replicas or improved versions containing new ideas and/or requirements (e.g. better resilience, compliance with new law, seamlessness, etc.).

after the disaster / Post-mortem : Scientific analysis of the complete Disaster Management Cycle can help to identify ex-post good and bad actions or decisions and can thus provide lessons learnt for the next disaster.

SUMMARY

Resilience, stability and survivability are highly desirable goals when trying to cope with disasters. Anticipation and System Thinking are closely intertwined activities when aiming at improving the reaction to a disaster. We have discussed some of the theoretical underpinnings of resilient systems and therefore their relation to and their need of anticipation. We have shown research challenges with respect to anticipation and systems thinking.

REFERENCES

Chroust, G., Ossimitz, G., Roth, M., Sturm, N., and Ziehesberger, P. (2015). First responders in regional disasters: a social responsibility. In Mulej, M. and Dyck, R., editors, *Social Responsibility - Range of Perspectives per topic and Countries*, page 23. Bentham Science Publishing Ltd., 2015.

IFRC (ed.) (2007a). Contingency planning guide. Technical report, International Federation of Red Cross and Red Crescent Societies, 2007.

IFRC (ed.) (2007b). Disaster response and contingency planning guide. Technical report, International Federation of Red Cross and Red Crescent Societies, 2007.

INSARAG (ed.) (2012). INSARAG Guidelines and Methodology Technical Report. Technical report, International Search and Rescue Advisory Group United Nations Office for the Coordination of Humanitarian Affaires, 2012.

ISO (2011). ISo 22320:2011, Societal security – emergency management – requirements for incident response. Technical report, International Organization for Standardization, 2011.

Khan, H., Vasilescu, L., and Khan, A. (2008). Disaster management cycle - a theoretical approach. *Management and Marketing Journal, vol. 6(2008) no. 1*, pages 43–50.

Loewenstein, A. (2015). *Disaster Capitalism*. Verso, London 2015.

McEntire, D. (2007). *Disaster Response and Recovery: Strategies and Tactics for Resilience*. Wiley, USA 2007.

Mrotzek, M. (2009). *Catastrophe Dynamics - A Systemistic Exploration of Catastrophes towards a Set of Catastrophe Archetypes Using the System Dynamics Simulation Method*. PhD thesis, Alpe-Adria University Klagenfurt, Faculty for Technical Sciences, Feb. 2009.

Poli, R. (2014). Anticipation: A new thread for the human and social sciences? *Cadmus, vol. 2 (2014), no. 3 , also http://cadmusjournal.org*, pages 23 – 36.

Rosen, R. (1985). *Anticipatory systems*. Pergamon Press, Oxford 1985. Singh, R. (2015) Why the strongest hurricane on record was no 'catastrophe'. *http://www.ifrc.org/en/news-and-media/news-stories/vamericas/mexico/ why-the-strongest-hurricane-on-record-was-no-catastrophe-70736/*.

Syvitski, J. (2009). Sinking deltas, encroaching tides. *Nature Geoscience 2, 681 - 686 (2009)*, page 6.

Taleb, N. (2012). *Antifragile: How to Live in a World We Don't Understand*. Penguin UK 2012.

Tierney, K., Lindell, M., and Perry, R. (2001). *Facing the Unexpected - Disaster Preparedness and Response in the United States*. Josef Henry Press, Washington DC, SA 2001.

Wood, C. (2013). Science during crisis: Group helps decision-makers with long-term strategy. *Emergency Management, Nov 6, 2013*, page 3.