Unravelling the Natural Hazard Risk-based Policy Development Knot

Miles Crawford[1], David Johnston[1,2], Emma Hudson-Doyle[1], Wendy Saunders[2], Graham Leonard[2]

[1]Joint Centre for Disaster Research, Massey University, New Zealand, [2]GNS Science, New Zealand

Challenges and solutions for natural hazard risk-based policy development in New Zealand interrelate within a complex system or knot, where many of the solutions are inhibited by the challenges. We explore the use of causal loop diagrams as a tool to unravel this complex system to better enable decision-makers to develop risk-based policy.

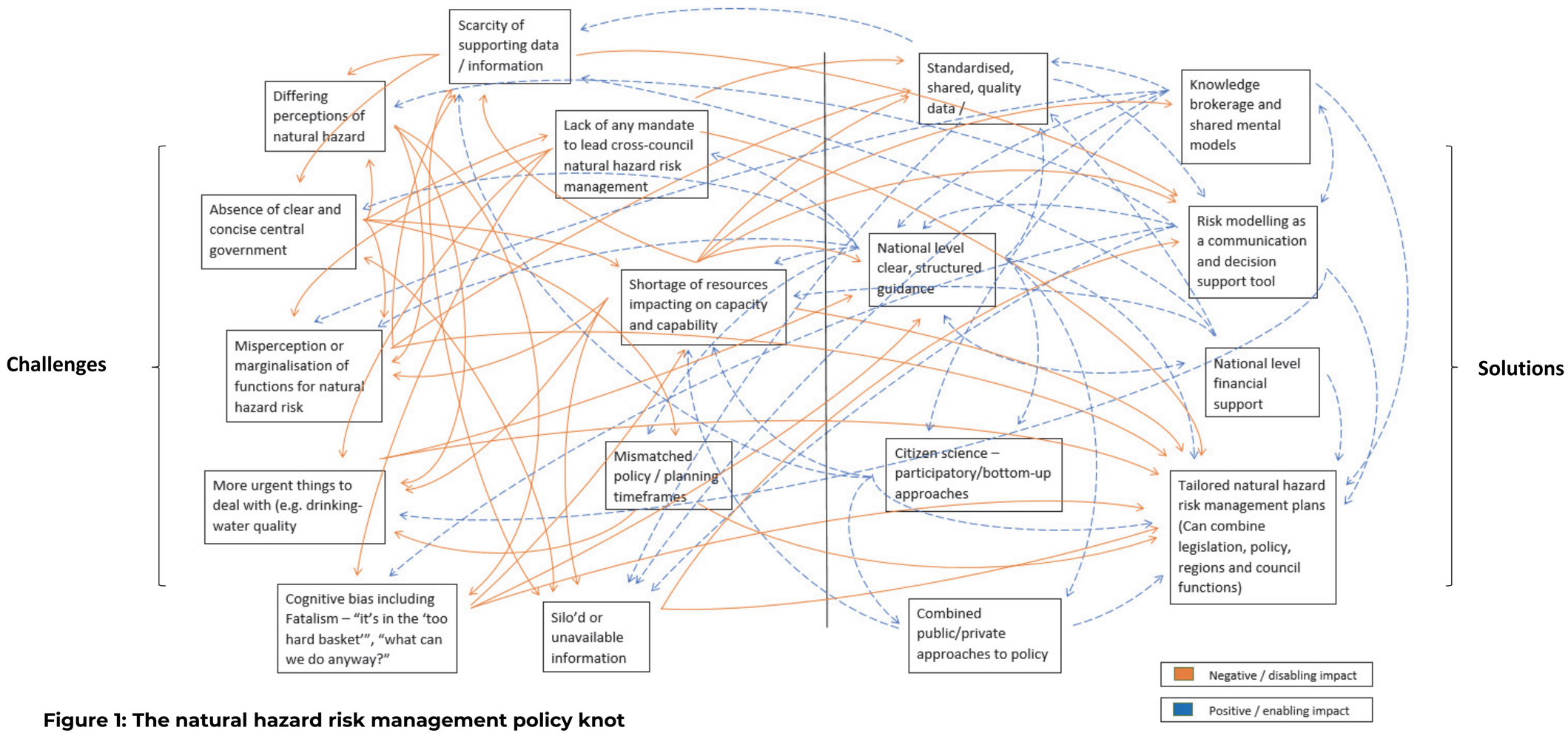

Figure 1: The natural hazard risk management policy knot

The natural hazard risk-based policy development knot

Figure 1 has been developed following interviews with local government natural hazard risk management practitioners in the Wellington, Hawke's Bay and Gisborne regions of New Zealand. It shows a complex, inter-dependent system of challenges and solutions for natural hazard risk-based policy development. Many of the solutions for policy development are inhibited by a number of challenges. This results in long timeframes for policy development and a shortage of risk-based policy.

Systems thinking

Systems thinking is one approach for controlling this inefficacy in developing risk-based policy. Systems thinking informs decision-making through better understanding of the system, the interrelated nature of elements in the system and identifying patterns of behaviour. It enables decision-makers to see the 'woods and the trees' by enabling them to focus on certain parts of the system, while acknowledging the whole.

Causal loop diagrams (CLDs)

A causal loop diagram is a systems thinking tool which approaches problems as a set of cyclic, feedback processes rather than a list of causes and effects. It is the loops themselves that are responsible for generating the behavior patterns exhibited in a system.

CLDs enable decision-makers to unravel complex systems like what is shown in Figure 1 and see the overall direction that the causal interrelations are taking. A reinforcing (R) causal loop strengthens itself where a balancing (B) loop equalizes itself.

Figure 2: CLD for a part of the natural hazard risk management policy knot

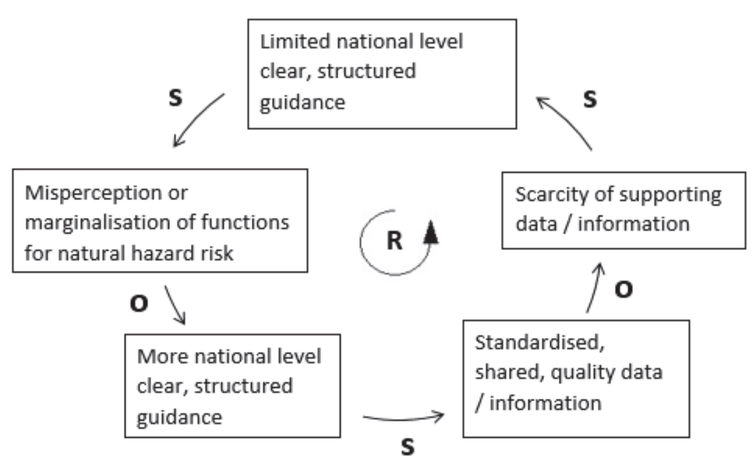

Figure 2 depicts a CLD developed from interrelations contained within Figure 1. Due to the distribution of same (s) and opposite (o) causes, the overall direction of the causal loop is reinforcing (R). A reinforcing loop can strengthen itself both positively and negatively. In the case of Figure 2, the reinforcing loop strengthens itself negatively, meaning that in this loop decision-makers are less enabled to develop natural hazard risk-based policy.

Unravelling the knot

By breaking down, or unravelling, complex systems into constituent CLDs, decision-makers gain a clearer understanding of the direction of each causal loop, and by default, the whole system. This enables to them to develop potential interventions, check how they behave within CLDs, and take positive steps towards developing natural hazard risk-based policy.

Australian Government Department of Industry, Innovation and Science | Business Cooperative Research Centres Programme