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# PROMOTING A NETWORK MINDSET TO SUPPORT HUMANITARIAN CRISIS MANAGEMENT: TOWARDS PREDICTION, PREVENTION AND RESILIENCE

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**Abstract**
Figures compiled by the Department for International Development (DfID) suggest that between 50,000 and 100,000 people, more than half of them children under five, died in the 2011 Horn of Africa crisis that affected Somalia, Ethiopia and Kenya. The accompanying destruction of livelihoods, livestock and local market systems affected 13 million people overall (Save the children, 2012). According to the World Economic Forum 'The world is insufficiently prepared for an increasingly complex risk environment' (WEF, 2015). The threats to human security are multiple, complex and interrelated and often mutually reinforcing. 'Global risks cannot be seen in isolation' (WEF, 2015). This hyper-connected world underpinned by hyper or hybrid-risks, has revealed '…the fragility and vulnerabilities that lie within the social/technological/economic/political/ecological interdependent systems' (Masys et al., 2014). It is through these underlying networks that Helbing (2013:51) argues that we have '…created pathways along which dangerous and damaging events can spread rapidly and globally' and thereby has increased systemic risks.
To enable resilience, a 'networked' understanding of hyper-risks (Helbing, 2013) is required providing a more holistic approach to hazard identification and risk management that transcends the linear agent-consequence analysis. The Horn of Africa humanitarian crisis shows how 'networked risks' are not confined to national borders or a single sector, and do not fit the monocausal model of risk (Masys, 2013). As argued by Renn, Klinke and van Asselt (2011:234) such risks or hyper-risks are '...complex (multi-causal) and surrounded by uncertainty and/or ambiguity'. Ramo (2009:74) notes that 'catastrophic changes in the overall state of a system can ultimately derive from how it is organized, from feedback mechanisms within it, and from linkages that are latent and often unrecognized'.
Such a threat landscape requires 'new ways of thinking' to manage the complex problems associated with human security. This paper will describe Network thinking (Xu and Masys, 2016) as an approach to facilitate the identification of the inherent interdependencies and interconnectivity of key factors that need to be addressed when assessing vulnerability in the context of natural hazards, climate change, man-made disasters and natural disaster triggered technological disasters (NATECH). In this way it leads us to better ways to manage humanitarian crisis through prediction, prevention and resilience.

**Keywords**: network thinking; resilience; hyper-risks; humanitarian crisis

**Introduction**

The 1994 Human Development Report by the United Nations Development Programme (UNDP) defines human security as 'freedom from fear and freedom from want' highlighting seven key components (economic, food, health, environmental, personal, community and political security). These seven components do not exist as isolated domains but are rather interdependent and interconnected. This has a significant effect on the transmission of risk across a community, region and nation. Masys et al. (2014:772) argues that 'with our hyper-connected world underpinned by hyper or hybrid-risks, the impact of unexpected events such as floods, earthquakes, financial crisis, and cyber-attacks has revealed the fragility and vulnerabilities that lie within the social/technological/economic/political/ecological interdependent systems'. This is certainly evident within the humanitarian crisis domain. Supporting resilience thereby requires '…understanding, controlling and predicting extreme behavior as an important strategic goal' (Johnson and Tivnan, 2012:65). Given this, a new paradigm is required to support disaster risk reduction (DRR) replete with hyper-risks across the humanitarian crisis and development domains; one that will develop not only anticipatory measures for risk management but also prepare for the unpredictable and the 'unknown' (Masys, Yee and Vallerand, 2015) by building organisational resilience.
Masys et al. (2014:773) argues that '...Understanding the fragility induced by multiple interdependencies is one of the major challenges in the design of resilient infrastructures'. Such systemic failures emerge from the interconnectivity that characterizes the 'network space'. As such our notion of risk and 'hyper-risks' (Helbing, 2013; Ray-Bennett et al., 2015; Masys et al, 2014) must be considered from a 'networked model' that recognizes the complex interdependencies and interconnectivity of the risk 'ecosystem' and the underlying understanding of failures, natural hazards and human-made disasters as it pertains to resilience. Masys et al (2014:773) argues that '...Network thinking or more clearly a 'network mindset' (Vespignani, 2009) is essential for understanding the network structure, network behavior and the feedback/feedforward effects resident within these systems. What emerges from the study of networks is the insightful requirement to evaluate actions and behaviours not in isolation but recognizing that cause and effect are complex and nonlinear'.

It is evident from the literature (Levine et al., 2011;, Masys, 2012, 2013; Wattie and Masys, 2014; Masys et al., 2014) that often policies and managerial decisions miss the mark in improving humanitarian crisis management and resilience and do not achieve desired outcomes, but actually lead to unexpected or unintended consequences (Masys, 2013). The problem stems from the complexity associated with the problem space of humanitarian crisis management whereby linear and 'siloed' thinking are too simplistic for 'human security systems' that are complex. Dekker, Cilliers and Hofmeyr (2011:941) argue that '...analytic reduction cannot tell how a number of different things and processes act together when exposed to a number of different influences at the same time. This is complexity, a characteristic of a system. Complex behavior arises because of the interaction between the components of a system. It asks us to focus not on individual components but on their relationships'. The inherent relationality within

such systems, as described in Masys et al. (2014) pertaining to Fukushima Daiichi nuclear accident, Hurricane Katrina and Masys (2013) pertaining to the Horn of Africa Humanitarian crisis, highlights as Reason (1997:32) argues that the '...path to adverse incidents is paved with false assumptions' and arise from unrecognized 'weak signals' that emerge from complex problems. Within such complex problem spaces, Barton and Sutcliffe (2009: 1338) argue that 'Although noticing small signals is important, our findings suggest that noticing is not sufficient to interrupt ongoing patterns of action and to stimulate re-evaluation. Rather, we found two critical social processes- giving voice to concerns and seeking alternative perspectives- that appeared to stimulate interruptions and consequently reorient the actors involved'. The humanitarian crisis emerges from a crisis of perception. Perspective thereby becomes an important factor in addressing assumptions associated with disaster and crisis mitigation, planning and response. Potangaroa, (2015) draws upon IDEO's approach to designing solutions. He argues that '….believing that all problems, even the seemingly intractable ones like poverty, gender equality, and clean water, are solvable. Moreover, it means believing that the people who face those problems every day are the ones who hold the key to their answer. Human-centered design offers problem solvers of any stripe a chance to design with communities, to deeply understand the people they're looking to serve, to dream up scores of ideas, and to create innovative new solutions rooted in people's actual needs.' Understanding the inherent complexity within the domains pertaining to humanitarian crisis management is a key enabler.

The distinction between natural and man-made disaster is being blurred. Vulnerabilities transcend this perceived dichotomy. Disaster events such as Hurricane Katrina (2005), Hurricane Sandy (2012), Fukushima Daiichi nuclear meltdown (2011), Typhoon Haiyan (2013) illustrate the devastating effects of natural disasters on human systems (Masys et al., 2014). When considering vulnerabilities in complex socio-technical and/or human systems, many of the risks share a common feature of being hidden or seeded within the system where they can lie dormant for long periods of time before emerging suddenly. This plays to the notion of hyper-risks (Helbing, 2013) and hybrid-risks (Masys et al., 2104). In terms of enabling resilience (Masys, 2014), Goldin and Mariathasan (2014: 208) argue that 'Physical, virtual and social networks need to be constructed in ways that allow them to withstand, and respond to the novel challenges of our time. They have to be flexible and organic rather than static and their capacities cannot be stretched to the limit'. The question becomes how do we conceptualize and manage for resilience in the face of extreme events and black swans (Taleb, 2007; Masys, 2012; Masys, Yee and Vallerand, 2015)?

**Network Thinking**

These complex problems associated with disaster management, black swans and extreme events can be characterised as messes and wicked problems (Masys, 2015). As described in Rosenhead and Mingers (2011: 4-5), 'Managers are not confronted with problems that are independent of each other, but with dynamic situations that consist of complex systems of changing problems that interact with each other. ...Problems may be solved; messes need to be managed'. The handling of wicked problems thereby requires a holistic rather than linear thinking approach. Understanding interrelationships, multiple perspectives and awareness of boundaries figures prominently in viewing messes and wicked problems. As noted by Dekker (2011:202)

'Complexity allows us to invite more voices into the conversation and to celebrate the diversity of their contributions'.
Most major failures arise not from simple unforeseen causes, but from highly complex human activity systems containing large numbers of interconnected subsystems and components (Xu and Masys, 2016). Events like Union Carbide accident, Deepwater Horizon, Fukushima Daiichi nuclear accident, the 2011 Horn of Africa humanitarian crisis illustrate that multiple and unexpected interactions characterise these problem spaces. Policies to reduce morbidity and mortality are developed within humanitarian crisis and development silos. Humanitarian aid, resilience and development are not a stand-alone phenomenon with clear boundaries. They are interrelated with natural and man-made precursors, and evolve over time. As such, humanitarian crisis, enabling resilience and development defy simple representation and thereby require a method that recognizes and maps the inherent interdependencies, interconnectivity, ambiguity and uncertainty. To help policy formulation in the face of ambiguity and uncertainty and avoid the unanticipated consequences of intervention strategies, policy makers and crisis decision makers need to understand humanitarian crisis, resilience and development as a complex system and apply the principles of complexity science.

Masys (2013) actor network analysis reveals underlying complexity pertaining to human security issues. Key characteristics apply to humanitarian crisis management, resilience and development:

- Structural complexity- the actor network emerges as a network of heterogeneous actors interrelated in a rhizomal 'network' topology.
- Network evolution- the actor network changes over time
- Connection diversity- relations between different actors are heterogeneous and are shaped by translation and inscription processes.
- Dynamic complexity- the actor themselves are actor networks, adding to the overall dynamic complexity of the system
- Actor diversity- actors are not homogeneous, they are heterogeneous
- Meta-complication- the factors above are all interrelated thereby adding another level of complexity in understanding the dynamic complexity of actor networks as it relates to human security. (derived from Strogatz (2001:269))

The analysis methodology of Actor Network Theory (ANT) applied to humanitarian crisis, 'Following the actors', revealed the notion of a complex co-evolving system characterized by '…intricate and multiple intertwined interactions and relationships. Connectivity and interdependence propagates the effects of actions, decisions and behaviours …, but that propagation or influence is not uniform as it depends on the degree of connectedness' (Mitleton-Kelly and Papaefthimiou, 2000). Through the complexity lens of ANT, a 'network mapping' highlights the complex spatial and temporal interdependencies that reside within the actor network (Figure 1). Moreover, it reveals the importance of interoperability across actors (technical, social, political and economic) and the notion of uncertainty and assumptions that can shape human security.

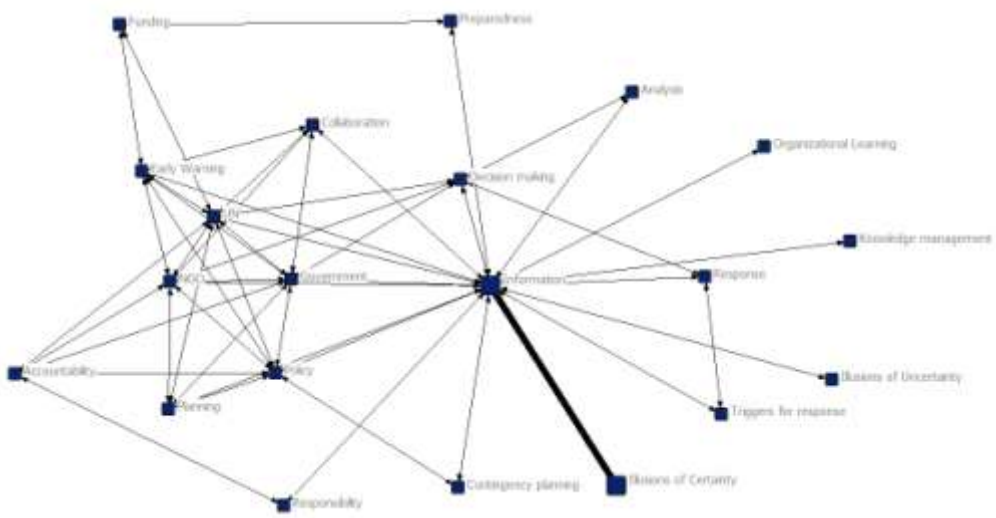


Figure 1. Actor Network Visualization- abridged high level view (Masys, 2013)

Levine et al (2011: 7) argues that '…a system perspective can often reveal how behaviour that is competent from the standpoint of each individual actor does not contribute to achieving the overall goals which collectively all the actors in the 'system' say they are working towards, in different ways. System problems often result when different actors do not really share the objectives, or when they do not agree on which elements contribute to a single system'. The reality is that complex problems involve conflicting goals. Divergent policy interpretations and mental models arise from and contain different assumptions, hard-wired politics (Masys, 2010, 2012) and understanding of resident uncertainties. From the actor network analysis it is argued that agendas and goals are not value neutral and have defining affects on the actor network dynamics.

Resilience thereby emerges from the analysis as a key quality of human security. The concept of resilience encompasses a capacity to anticipate and manage risks and the ability to survive threats and respond to challenges. Woods (2006:316) asks the question:

> 'How do people detect that problems are emerging or changing when information is subtle, fragmented, incomplete or distributed across different groups involved in production processes and in safety management. Many studies have shown how decision makers in evolving situations can get stuck in a single problem frame and miss or mis-interpret new information that should force re-evaluation and revision of the situation assessment (Johnson et al., 2001; Patterson et al., 2001).'

Within this mindset it is recognized that there exists a disproportionality of 'causes and effects', in which as Urry (2002:59) remarks, past events are never 'forgotten', they are seeded (manufactured) in the actor network (Masys, 2012, 2013, 2016; Masys et al., 2014). Ramo (2009:74) notes that 'catastrophic changes in the overall state of a system can ultimately derive from how it is organized, from feedback mechanisms within it, and from linkages that are latent and often unrecognized'. Many interconnected and interdependent elements within human security systems and their contexts create extensive networks of feedback loops with variable time lags between the cause and effect of an action and non-linear relationships between system elements, collectively creating a 'dynamic complexity'. As a complex adaptive system, the

system dynamics evolve from the interactions among the system's elements rather than the result of a change in one component. Understanding this interconnectedness and complexity is the essence of network thinking that views the system as a whole rather than its individual component parts, taking into account behaviour of systems over time rather than static 'snapshots' (Senge 1990), with 'the ability to see the world as a complex system' (Sterman 2001). A comprehensive approach (Masys, 2014) is a systems construct to manage such complex issues.

Complex systems are composed of networks of interconnected components that influence each other, often in a nonlinear fashion. From this we must acknowledge the interplay within and between such systems. Figure 2 highlights the complex aetiology associated with the 2003 US/ Canada Blackout through the lens of ANT. Resident pathogens, misaligned policies and legislation, lack of effective scenario analysis figure prominently. Complex systems analysis goes beyond the reductionist approach of breaking complicated phenomena into simple variables; new properties and behaviours evolve from the interactions between individual components.

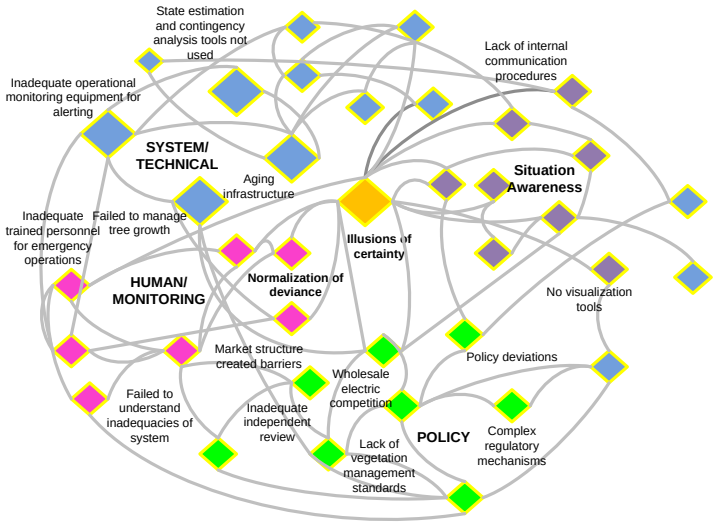


Figure 2: Actor Network (resident pathogens) (Masys, 2014a)

To enable resilience (Masys, 2014b) in these complex problem spaces requires the application of various tools and approaches (Masys, 2015) that recognize the wicked nature of the problem space. Such approaches as Soft Systems Methodology (SSM) (Checkland, 2001), systems thinking (Senge, 1990; Masys, 2015), Actor Network Theory (Masys, 2010, 2012, 2013, 2014), System dynamics and agent based modeling can support problem framing (Masys, 2015).

Network thinking can help address the linear and reductionist approaches which prevail in humanitarian crisis management, by enabling testing of new ideas in social systems through such approaches as scenario analysis (Masys, 2012) and modelling and simulation (Masys and Vallerand, 2015; Masys, Yee and Vallerand, 2015). In network thinking, the humanitarian crisis domain is viewed as a complex whole of interrelated and interdependent parts rather than

separate entities. In so doing, network thinking takes into account the structures, patterns of interaction, events and organizational dynamics as components of larger structures, helping to anticipate (through scenario planning and assumption base planning) in a proactive posture in order to better prepare for emerging challenges. What this means is that careful consideration of possible consequences of policies and actions, generating scenarios through group working and joint thinking (Masys, 2012) and engagement with hypothesis testing is a requirement of the solution space.

Resilience, as a property of a system, must transition from just a buzzword to an operational paradigm to support humanitarian crisis management. In so doing, one must consider the way risks emerge, combine and travel. Scenario analysis and Modelling and simulation of complex, interconnected socio-technical systems allows decision makers, planners and managers to identify weak spots, plan counter-measures in advance and have situation awareness of ongoing dynamics (Weick and Sutcliffe, 2007) in a comprehensive way, for diverse and heterogeneous threats and vulnerabilities.

## Conclusion

Given the complexity associated with humanitarian crisis management, enabling resilience and development, 'new ways of thinking' are required (if not essential) to manage the complex problems associated with this human security domain. Employing network thinking as a theoretical framework for work means reconceptualizing the fundamental way we think about problem framing (Masys, 2015). The language of Complexity Science helps to articulate a way to open the blackbox of crisis and disaster aetiology in a proactive way and map networks of actors that reveal the inherent interdependencies and interconnectivity and thereby become sensitive to emergent behaviour in complex adaptive systems.

As concluded in Masys et al (2015) and highly applicable within the context of humanitarian crisis management, the application of network thinking and M&S tools and techniques:

> '...coupled with involvement of experts, stakeholders and the public can provide insights and unique and timely advice to support disaster risk reduction and the resulting risk handling and response strategies. Furthermore, emerging research areas focused on the elucidation of some fundamental organising principles that govern the behavior of diverse networks may confer significantly improved predictive power in a theory of complexity, and this increased understanding of natural or technological networks may facilitate the design of network topologies that are much more tolerant to both failure and attack'.

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