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# HYPER-RISKS IN A HYPER-CONNECTED WORLD:

A call for critical reflective response to develop organisational resilience

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# Contents

# Introduction: Objectives of the Hyogo Framework for Action (HFA) and its Impact Worldwide

The Hyogo Framework for Action (HFA) is the conclusive review of the United Nation's (UN) International Decade for Natural Disaster Reduction (IDNDR) (1990-2000) (Resolutions 43/202) and Mid-Term Evaluation of IDNDR in the Yokohama Strategy in 1994 (UN, 1999; UN, 2005). Currently the HFA is the key instrument for implementing disaster risk reduction (DRR). The UN's International Strategy for Disaster Reduction (UNISDR, 2009) defines DRR as:

> *'The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events'*.

The origin of DRR is rooted in the risk management theories which gained its prominence in the mid 1980s in the West (JONES and HOOD, 1996). Increasingly, risk has become the most powerful concept in modern society (JONES and HOOD, 1996; DENNEY, 2005; BECK, 2009). Furthermore, the mainstreaming of the DRR approach by the HFA in 2005 has led to an increasing level of 'risk appetite' in the developing nations that previously was unforeseen (RAY-BENNETT, 2009, 2012). This has led to two significant changes:

1. Reduction in human mortality in the developing nations; and
2. A shift from reactive to pro-active disaster response through preparedness and mitigation.

Both of these changes are inter-connected and are explained below.

DRR is geared towards developing nations rather than the developed nations (JONES, 1996). This is partly because in the IDNDR, the UN and the international community was forced to refocus on developing nations due to the disproportionate effect of 'so-called' 'natural' or environmental disasters in developing countries (JONES, 1996; JONES and HOOD, 1996). Similarly, the World Conference on Disaster Reduction in Japan in 2005 observed that disasters are on the rise with a debilitating effect on the developing nations (UN, 2005). It is known that the achievement of the Millennium Goals by 2015 is much harder for those countries repeatedly affected by disasters (DFID, 2005; UN, 2007a). Asia is a case in point

where 85% of all disaster affected people in the world are located either in Bangladesh, China or India (NATHAN, 2009).

However, in light of the recent events in South Asia, the positive impact of the HFA is beginning to emerge. Millions of 'at risk' people were evacuated and saved from the effect of cyclone Phailin on 12th October 2013 in the eastern state of Orissa, India. In 1999 a super-cyclone with the similar wind velocity had killed more than 10,000 people in Orissa (RAY-BENNETT, 2009; GOVERNMENT OF ORISSA, 2002) whereas only less than five people were killed in 2013 (BBC, 2013)[1]. In Bangladesh the cyclone in 1991 killed more than 135,000 people whereas in the cyclone Sidr in 2007 the death toll was 3,300. In the event of cyclones Aila in 2009 the human death toll was further reduced to 190 (BRITISH RED CROSS, 2007; 2011)[2] and 14 in Mahasen in 2013 (ABC NEWS, 2013)[3].

These are laudatory successes for the DRR community. These successes have been possible due to the HFA's emphasis on:

1. Adopting anticipatory measures (JONES, 1996; UN, 2005);
2. Promoting qualitative and quantitative risk and vulnerability management strategies (for details see HOOD and JONES, 1996; WISNER et al., 2004; UN, 2005);
3. Promoting 'safety culture' and 'active learning' from disasters (TOFT and REYNOLDS, 2005); and
4. Continuing with relief, emergency, rescue and insurance (HOOD and JONES, 1996; PANTOJA, 2002; UN, 2005; RAY-BENNETT, 2010, 2012).

The HFA has also recognised the mutual importance of integrating disaster into the development paradigm. It urged the involvement of different stakeholders, the adoption of a multi-sectoral approach and the devolution of disaster management activities (UN, 2005). All of these have led to an increasing level of awareness, knowledge and preparedness amongst the government, responding organisations and 'at risk' people (IFRC, 2006; IPCC, 2007; UN, 2007b; ALLIANCE DEVELOPMENT WORKS, 2012; UN, 2007a; ENARSON, 2009; DFID, 2012).

[1] http://www.bbc.co.uk/news/world-asia-india-24516293 [Accessed on 6 January 2014].

[2] http://www.redcross.org.uk/What-we-do/Emergency-response/Past-emergency-appeals/Bangladesh-cyclone-2007/Why-we-needed-your-help [Accessed on 6 January 2014]. And http://www.redcross.org.uk/What-we-do/Emergency-response/Past-emergency-appeals/Bangladesh-cyclone/Why-people-need-help-after-Cyclone-Aila [Accessed on 6 January 2014]

[3] http://www.abc.net.au/news/2013-05-17/14-killed-as-cyclone-hits-bangladesh/4695404 [Accessed on 6 January 2014]

However, the HFA is tacit in explaining how to build the capacities of those organisations that apply principles of DRR into practice in their own context. The Framework places much emphasis on the capacity building of the 'at risk' community rather than the organisations and professionals who are involved in the day-to-day 'messy' businesses (SCHÖN, 1983) of averting disaster risks. As a result, the building of organisational capacity in national and local authorities, non-governmental organisations and environmental agencies has received far less attention by the DRR community (for instance see DFID, 2006, 2012). This paper posits that the capacity building of the responding organisations is pivotal in the context of hyper-risks. The caveat of the HFA is that it fails to capture the complexities of the post-modern world and that of the organisations (ARGYRIS, 1960) in this hyper-connected world. This paper aims to address this gap through the instance of natural disasters which trigger technological disasters (also known as NATECHs) in general and the case of Fukushima in Japan in particular. In doing so, 'reflective response' is introduced to the dominant crisis and disaster management practices, one that is based on 'critical reflective practices' to address hyper-risks (VAUGHAN CENTRE FOR LIFELONG LEARNING (VCLL), 2013).

## Scopes for Hyper-Risks in a Hyper-Connected World: The Case for Natural Disasters which Trigger Technological Disasters (NATECH)

The fundamental characteristic of today's world is its interconnectedness and interconnectivity that lends itself to a 'risk society' (BECK, 1992) and a 'world risk society' (BECK, 2009). BECK (1992) described the modern or post-industrial landscapes as a 'risk society'. The industrial society is the distribution of 'goods' whereas the risk society is the distribution of 'bads' or dangers. Risk society is the by-product (or residue) of the industrial society which produces 'risk society's risk' and 'dangers' in conjunction with science. Although the interconnectivity in risk society supports and enables global prosperity, it also increases vulnerability to transnational risk (BECK, 2009). More and more we see the consequences of disasters extend beyond borders having regional and global reach. An example is the ash cloud resulting from the 2010 eruption of Eyjafjallajökull which led to the disruption of some 100,000 flights and 10 million passenger journeys (EUROCONTROL, 2010)[4].

[4] https://www.eurocontrol.int/sites/default/files/attachments/201004-ash-impact-on-traffic.pdf [Accessed on 6 January 2014]

The landscape of the risk society is then highly vulnerable to social, natural and technical hazards. The dangers and 'bads' created from these hazards has the potential to spread both locally and globally due to the nature of interconnectedness. Also these 'bads' have the potential to jeopardise livelihoods, natural resources and ecosystem services of the current and future generations. No longer can we view impacts as discrete events and as the sum of their local consequences. The mental models we use to conceptualize risk must address the complex and dynamic interconnectivity and interdependence that exists in systems. Consequently what has emerged from the hyper-connected world are 'hyper-risks' (HELBING, 2013).

### *What are Hyper-Risks?*

According to HELBING (2013) hyper-risks arise from the inherent interdependent social/ecological/physical/economic/political networks. UNISDR (2009) defines 'risk' as "the combination of the probability of an event and its negative consequences". In the context of this paper this definition is extended to define hyper-risks as not only 'an event' but also processes that trigger an event or series of unpredictable events with a likelihood of trans-border cascading effect.

Hyper-risks are hybrid risks. They are hybrid in the sense that 'a number of basic features that may have often been regarded as mutually exclusive' (BECK, 2009) by the dominant risk, crisis and disaster theories are inclusive and fused. Hyper-risks are connected to several systems such as the society, environment, organisation and the like. In contrast, the dominant risk framework compartmentalises risks and hazards into three types: natural, social and technological (JONES and HOOD, 1996; BECK, 1992). These are useful analytical distinctions. But in the context of hyper-risks they overlap and intersect to produce hybrid hazards known as quasi-natural hazards or NATECH hazards (JONES and HOOD, 1996; DAVID, OVERFELT and PICOU, 2007). As a result, the conventional distinction between these three types of hazards has come under serious challenge from the disaster sociologists and geographers in light of recent disasters such as the Hurricane Katrina (DAVID, OVERFELT and PICOU, 2007) and the Tohuku Earthquake.

Hyper-risks are unpredictable risks like the black swans or wild cards (TALEB, 2007). Black swans represent the unpredictable. They represent "[…] our misunderstanding of the likelihood of surprises" (TALEB, 2007). A black swan is described by TALEB (2007) as an outlier, which is outside the realm of regular expectations and carries with it an extreme impact such as natural disasters, market crashes, catastrophic failure of complex socio-technical systems and terrorist events such as 9/11. These 'surprising events' reflect an

organiSations inability to recognize evidence of new vulnerabilities or the existence of ineffective countermeasures (WOODS, 2006). This necessitates the requirement to readjust to their existence and thereby the need to consider the extremes (TALEB, 2007).

The emerging and systemic risks and inherent uncertainty associated with surprising events, requires understanding of the variety of possibilities in order to facilitate management of these hyper-risks. Many of the systemic risks that characterize the disaster risk often arise from unanticipated consequences of interactions within and between different types of systems. In this light, a new paradigm is required to support DRR embedded in hyper-risks; one that will develop not only anticipatory measures for risk management[5] but also prepare for the unpredictable and the 'unknown' by building organisational resilience (WILDAVSKY, 1988; quoted in HOOD and JONES, 1996; TALEB, 2007) for hyper-risks in general and NATECH disasters in particular.

This merits the question, how can we build organisational resilience to comprehend hyper-risks. There are several ways to promote organisational resilience. This paper, proposes a 'reflective response' one that is based on 'critical reflective practices' (VCLL, 2013). This discussion is resumed following the section on NATECH.

## *The Case for NATECH*

Many recent studies show an increasing number of NATECHs (OZUNU et al., 2011). Their significant negative consequences affect communities all over the world, especially those which are not prepared for such events. NATECHs occur at the seams of natural, environmental and technological hazards. It is the conjoint natural/technological disaster that makes the NATECH situation so different and complex (CRUZ and KRAUSMANN, 2008) as it challenges risk management and risk governance. In this hyper-connected world, the NATECHs emerge as the reification of these hyper-risks. The inherent complexity of such accidents thereby suggests the requirement for a more inclusive risk governance. CRUZ (2012) argues that NATECH risk governance

> *'should involve many players and stakeholders including the industrial facility owners/ operators and its contractors, suppliers, etc., but also government officials […], first responders, neighboring industrial facilities, and residents, among others'*.

[5] Anticipatory measures include detection, prevention, regular 'health checks' of potentially vulnerable organisations/structures/location and putting precautionary measures in place (HOOD and JONES, 1996 ; PENNING-ROWSELL, 1996; WISNER et. al., 2004))

In this way multi-vocality is embraced as part of the reflective practice solution space, along the lines of a comprehensive approach (MASYS, 2014). Although awareness of the need to better address NATECH risk has been on the rise (see CRUZ, 2012), gaps remain across the board in terms of collective awareness as shown by the lack of NATECH risk governance internationally or organisationally. The consequences of these conjoint events are much more substantial for communities than those posed by each hazard alone. This paper therefore moves from the traditional concept of crisis and disaster management to one of complexity management that can respond adequately to the conjoint NATECH disaster. What emerges from the analysis of the NATECH case studies/literature regarding gaps (see STEINBERG, SENGUL and CRUZ, 2008 ; CRUZ and OKADA, 2008 ; KRAUSMANN and MUSHTAQ, 2008 ; KRAUSMANN and CRUZ, 2013 ; CRUZ, 2012 ; OZUNU et al., 2011) is how reflective practice can be harnessed to support preparedness and emergency planning through mindfulness in order to understand NATECHs and mitigate their consequences.

## From Reactive to Pro-active to Reflective Response

In 2005, the HFA urged the DRR community to shift from a reactive to pro-active disaster response. To tackle hyper-risks 'reflective response' is proposed. Reflective response is a combination of individual, organised and critical reflections and reflective strategies embedded in an organisation's context. Reflective response is not a stand-alone response; it is rather complementary to those which are reactive and pro-active. Currently there is a dearth of DRR case studies that employ reflective practices. However, there is some evidence of such application to the domain of international development and capacity building (PATTON, 2011 – discussed later). The advantage of promoting 'reflective response' is that it builds the capacities of organisations and 'communities of practice' to deal with reactive and pro-active responses. 'Communities of practice' means 'where participants share understandings about what they do and what the doing means for them and for their communities' (LAVE and WENGER, 1991; quoted in WELSH and DEHLER, 2004). According to TURNER (1999), communities of practice are influential because they exchange experience and they can be brought together to build webs of relationships in order to develop organisational capacities and learning (TURNER, 1999) relative to hyper-risks.

This paper concurs that building resilience of the 'at risk' community (current emphasis of the HFA) is highly pivotal but also building the capacities of the organisations and communities of practice is equally important in this hyper-connected world. Both are mutually inclusive. It is argued that a robust and resilient organisation is better equipped to

deal with hyper-risks when compared to a weak and non-resilient organisation. A 'resilient organisation' is understood as a 'learning organisation' which does not unravel in 'unpredictable' disasters and 'hyper-risks'. A resilient organisation is realised only when the communities of practice are supported and nurtured as part of the overall goal of resilience. Such an organisation will also be in a better position to respond and mitigate disaster risks both internally as well as externally for the 'at risk' community. Therefore, a robust and resilient organisation is key to effective DRR. To build organisational resilience this paper proposes reflective response, which has its roots in management, education, psychology and social care studies and practices.

## *Three Tenets of Reflective Response*

As mentioned earlier, reflective response is a combination of individual, organised and critical reflections and reflective strategies embedded in an organisation's context. All the three tenets are mutually inclusive to build organisational resilience for hyper-risks.

## *Individual Reflection*

Individual reflection has its roots in 'critical social sciences[6]' (MEZIROW, 1981). John Dewey the American philosopher and an educationalist is arguably considered to be the father of modern reflection theory not only for learning and education but also for management studies (REYNOLDS and VINCE, 2004). For Dewey thought and action were inextricably interlinked. Inspired by Dewey's work, SCHÖN (1983) analysed the gap that exists between theory and practice of the practitioners dealing with 'messy problems' of the day-to-day workplaces through the model of 'reflective practice' and 'reflective practitioner' (KARBAN and SMITH, 2010). Schön brings to the fore the idea that reflection is not only retrospective, but also an element of the experience (REYNOLDS and VINCE, 2004). More concretely he made the distinction between 'reflection-in-action[7]' and 'reflection-on-action' as a way of thinking about a situation whilst engaged within it, in order to reframe and solve some breakdown in the smooth running of experience (PLAGER, 1994; SCHÖN, 1983).

[6] 'Critical social sciences have the goal of critique. They attempt '[…] to determine when theoretical statements grasp invariant regularities of social action as such and when they express ideological frozen relations of dependence that can in principle be transformed' (HABERMAS, 1971 ; quoted in MEZIROW, 1981:5).

[7] HICKSON (2011 using SCHÖN, 1983) explains reflection-in-action as the thought that we take whilst involved a situation, during which we become aware of what we are thinking, feeling and doing. Reflection-on-action, on the other hand, takes place sometime later, when we consider the events that took place, and recall what we were thinking, feeling and doing. Consequently, reflection-in-action is based on a rapid interpretation of the situation (GHAYE and GHAYE, 1998). It indicates that it commences in the middle of action, whereas 'reflection-on-action' occurs after the event to improve future action (GHAYE and GHAYE, 1998; SCHÖN, 1983).

The concept of 'sense making' in organisations (WEICK, 1995) is another important aspect of reflection. Sense-making means 'making of sense' (WEICK, 1995) 'about an activity or a process' that requires 'interpretation' (WEICK, 1995). According to WEICK (1995), sense making has a 'strong reflexive quality' to the process of interpretation because "people make sense of things by seeing a world on which they already imposed what they believe.

According to JOHNS (2009) reflection is a 'whole brain stuff'. This means a balance between the right side of the brain (that is concerned with creativity, imagination, perception, intuition, synthesis, wonder and spirit) and the more dominant left side of the brain (that is concerned with qualities of the mind associated with analysis, reason, rationality and logic). According to Johns reflection is then a balanced approach which requires a shift in thinking and new ways of responding. To him, reflection is a way of being within everyday practice (JOHNS, 2009).

### *Organised Reflection*

The theories of 'organised reflection' or collective reflection emerged as a critique to the theories on reflection (REYNOLDS and VINCE, 2004). Organisational theorists[8] argued that 'reflection' did not fully capture the critical perspective of reflection in the context of organisation and management studies (ANTONACOPOULOU, 2004; KAYES, 2004; NICOLINI et al., 2004; REYNOLDS and VINCE, 2004; WELSH and DEHLER, 2004). According to them reflection has to go beyond the individual to draw lessons from the power relations (KEMMIS, 1985) within and between communities of practice in order to advance professions and management practices (WELSH and DEHLER, 2004). Reynolds, in particular, spearheaded this initiative by taking reflection to a 'higher level' and introducing a 'critical element into the process' (WELSH and DEHLER, 2004). They argued that reflection has to be 'less about the individual reflective practitioner and more about organizing reflection' (REYNOLDS and VINCE, 2004). Based on this tenet, REYNOLDS and VINCE (2004) conceived the concept of 'organised reflection', one that takes account of "social and political processes at work in the organization of reflection". The emphasis is "placed [...] on creating collective and organizationally focused processes for reflection" (REYNOLDS and VINCE, 2004). Organising reflection is also linked closely to developing strategies for organisational development (see ANTONACOPOULOU, 2004; KAYES, 2004; NICOLINI et al., 2004; REYNOLDS and VINCE, 2004; WELSH and DEHLER, 2004).

[8] These theorists have their roots in the critical management studies.

## *Critical Reflection*

Central to critical reflection is the framework of 'organisational learning' and 'learning organisations'. Organisational learning is learning that takes place at an organisational level and as a result gains new knowledge (ARGYRIS and SCHÖN, 1996; quoted in FOOK, 2004). Organisational learning understands the organisation itself as an entity:

> *which has a life over and above its individual elements […] [to] bring about organisational learning, specific aspects of the organisation need to be work with (ARGYRIS and SCHÖN, 1996; quoted in FOOK, 2004).*

The framework of a 'learning organisation', on the other hand, engages with systemic thinking, teamwork and work based learning of a practitioner/s within the wider organisational context (SENGE, 1990; GOULD, 2004).

'Learning organisation' is different to 'organisational learning'. Organisational learning talks about the processes through which learning takes place, whereas learning organisation is about characteristics of an organisation that learns (GOULD, 2004). A learning organisation focuses on the different parts of an organisation by making connections between individual learning for organisational change (SENGE, 1990). In a learning organisation "people are continually discovering how they create their reality. And how they can change it" (SENGE, 1990) being a part of the world rather than a separate entity.

Learning organisation goes beyond the confines of an organisation to connect with the global world to promote learning at individual, collective as well as organisational levels. Learning organisation also values human agencies who are capable of making decisions for personal and professional development as well as for the organisation. According to SENGE (1990) systems thinking is then played out through the paradigm of interdependency, complexity and wholeness. This thinking is seminal for hyper-risks as evident in the case of Japan – discussed later.

Culture is another key aspect to learning organisation (BALDWIN, 2004). By reflecting critically on the broad concept of culture, it enables one to grasp the worldviews that people share based on their race, class, gender, caste, disability, and ageism for instance. These shared and collective perspectives have historical, social and political dimensions. If these are understood correctly learning organisations can promote 'a culture of learning' in project teams as well as in developing effective services (BALDWIN, 2004) for the hyper-connected world. However, GOULD (2004) argues that although organisational learning and learning organisations exhibit different characteristics, there are still areas of overlap as listed below:

1. *'Individual learning is necessary but not sufficient enough for organisational learning, whereas learning organisation is a collective process which means that organisation has not automatically learned due to an individual learning.*

2. *The learning experience is more pervasive and distributed than that delivered through a specific, designated training or educational event; learning incorporates the broad dynamics of adaptation, change and environmental alignment of organisations, takes place across multiple levels within the organisation, and involves the construction and re-construction of meanings and worldviews within the organisation' (GOULD, 2004).*

In the context of DRR, the framework of organisational learning and learning organisations are equally important to understand the disparate and diverse practices that exist worldwide.

## Methodology and Methods of Applying Reflective Response

According to HICKSON (2011):

> *'there are a myriad of methods, tools, techniques and frameworks for reflective practice and these methods can be used individually, in a group, online or by following a self-help book'*.

Reflective response is an under-researched topic in DRR, therefore, more empirical research is required to identify the appropriate methodology and methods in order to make sense of hyper-risks.

In the context of this paper, HABERMAS's (1973) interpretive approach is adopted to analyse the case of Fukushima. This is a methodology which refers to the "science of interpretation and explanation" (MEZIROW, 1981) rather than relying solely empirical analytic (MEZIROW, 1981). This methodology includes descriptive social science (MEZIROW, 1981; HABERMAS, 1973) and offers an edge to interpret the complexity of hyper-risks in light of the case study.

Whilst critiquing the epistemology of knowledge, HABERMAS (1973) differentiated the three generic areas in which human interests generate knowledge: the technical, the practical and the emancipatory. The technical knowledge involves instrumental action that is based upon "empirical knowledge and is governed by technical rules" (MEZIROW, 1981). Practical knowledge, on the other hand, begs for description, explanation and a systematic enquiry to understand the meaning rather than to establish causality. According to Habermas, when such interpretations can be gained through explanations

> `*they find their legitimate value within the therapeutic context of the reflexive formation of volition. Therefore they can only be translated into processes of enlightenment which are rich in political consequences'* (HABERMAS, 1973).

This kind of knowledge then leads to emancipatory knowledge which involves an interest in "self-knowledge, that is, the knowledge of self-reflection" (HABERMAS, 1973; MEZIROW, 1981) as well as collective reflection (FREIRE, 1972) to solve problems. A learning organisation should aim in the production and accumulation of all the three knowledge in this hyper-connected world. To facilitate this knowledge production it is suggested that a learning organisation can combine the tools or methods of critical reflective practices[9] and of systems thinking[10] (STERMAN, 2000; SENGE, 2006; and SENGE et al., 1994; DEWAR et al., 1993; FARBER and LAKHTAKIA, 2009; SCHOEMAKER, 1993). The consequences of producing one type of knowledge over the other can have a detrimental effect, as this can be deciphered in the case of Fukushima in Japan.

## The Case of Fukushima in Japan

On 11 March 2011 Japan was hit by yet another devastating earthquake named the Great East Japan aka Tohoku. The Tohoku earthquake triggered a giant tsunami that reached the height of 40.5 meters in the city of Miyako and killed more than 15,844 people, and destroyed many businesses, livelihoods and homes. The tsunami also sparked nuclear accidents including the meltdown of three nuclear reactors in the Fukushima Daiichi Nuclear Power Plant.

The destruction of the Fukushima Daiichi nuclear power plant resulted in massive radioactive contamination of the Japanese mainland. The hyper-risks associated with this NATECH resulted in radioactive caesium entering the ecosystem, and becoming ubiquitous, contaminating water, soil, plants and animals. It has been detected in a large range of Japanese foodstuffs, including spinach, tea leaves, milk, beef, and freshwater fish up to 200 miles from Fukushima (STARR, 2013). The contamination from the radioactive caesium affected 11,580 square miles (30,000 sq km) of the land surface of Japan (STARR, 2013). Estimates of the total economic loss range from US$250-$500 billion and the displacement of over 150,000 people. For the global nuclear industry, the accident has led to "regulatory changes that may slow or even eliminate plans for expansions of and investment in nuclear power in many countries" (CRUZ, 2012) thereby affecting the global energy market.

[9]For instance see GIBBS's (1988) 'experiential learning cycle' ; PEARSON and SMITH's (1985) 'briefing and debriefing'; BOLTON's (2005) reflexivity as an important strategy; POWELL's (1985) autobiographical learning, such as keeping diaries, journals and portfolios on a regular basis in order to reflect and develop strategies ; KNIGHTS's (1985) effective supervisor; ANTONACOPOULAOU's (2004) 'feedback' and (ARGYRIS, 1960) 'feed-upon' are other important methods of learning and changing and embracing complexities.

[10] To mention a few examples see 'Casual Loop Diagrams' (STERMAN, 2000; SENGE, 1990; and SENGE et al., 1994) ; 'systems synamics' (SD) (STRERMAN, 2000) ; 'assumption based planning' (ABP) (DEWAR et al., 1993) ; 'scenrio planning' (MASYS, 2012 ; FARBER and LAKHTAKIA, 2009).

## *Responding to NATECH Disasters: The Case of Reactive and Pro-active Disaster Response*

Japan is highly prone to earthquakes and typhoons due to its geographic location. These hazards had killed more than 1000 people almost every year until 1960 (CABINET OFFICE, 2010). In 1959 Ise-wan typhoon brought severe damage to Japan. This typhoon triggered high tides killing more than 5000 people. This event was an eye-opener for the Japanese society and led to the establishment of the central disaster management system in the 1960s. In order to realise this system, the 'basic law' for disaster management was established in 1961. Since the 'basic law' was established based on the lessons learnt from the former disaster experiences, Japanese disaster management is quintessentially reactive in nature.

It is reactive in the sense that the basic law is revised or amended after each disaster rather than prior to an event or in preparation for 'unknown' hyper-risks. However, at the same time, this practice can be understood as pro-active as well. This is because the Japanese society has been able to reduce the impact of medium size hazards since 1960s. This was partly due to the lessons learnt from previous disasters and partly due to implementing the measures required to mitigate the impact based on the production of technical knowledge. As a result of the dominant practice of reactive and pro-active disaster responses, the NATECH disaster does not feature in the basic law, albeit Japan has a historical record of experiencing tsunamis.

The management of nuclear accidents in Japan is also reactive. The first commercial nuclear plant was started in 1965 in Tokai village, Ibaraki prefecture. Before a decade of criticality, the nuclear basic law was established to promote atomic related research, development and actual use. The Nuclear Safety Commission was established in 1978 to improve nuclear safety. This commission was a result of an accident of a nuclear-powered ship 'Mutsu' in 1974. In 2000 the commission was reformed drastically in reaction to the accident in JOC plant which killed 2 staff by radiation exposure in 1999.

Another key point is that disaster management and nuclear accident management in Japan have been implemented separately not only in practice but also in research. By way of illustrating this point it is worth noting that there have been more than 1200 articles in the Journal of Japan Society for Natural Disaster Science, however, as of 2013, not a single nuclear related article has been produced in the publication. Some universities have a

nuclear related research institute, but each is estranged from the national disaster management institute[11].

### *Scope for Reflective Response*

A close scrutiny through the lens of reflective response reveals the caveat of the Fukushima case. Most importantly, the dominant reactive and pro-active disaster responses reveal their inadequacies to comprehend as well as prepare for NATECH disasters.

According to the Carnegie Foundation expert panel members ACTON and HIBBS (2012)[12], the methods used by Tokyo Electric Power Company, Incorporated (TEPCO) and Nuclear and Industry and Safety Agency (NISA) - which has been reorganised into Nuclear Regulation Authority (NRA) in 2012 - to assess the risk from tsunamis lagged behind international standards in three critical ways:

- ***'Historical Evidence of Disasters:*** *Acton concluded that TEPCO and NISA did not give sufficient attention to historical evidence of large earthquakes and tsunamis in the region surrounding the plant. Specifically, evidence that the region had been inundated about once every 1,000 years by tsunamis (most recently in 869 AD) was not followed up appropriately.*
- ***Tsunami Modelling Procedures:*** *There appears to have been deficiencies in the tsunami modelling procedures used by TEPCO. Most importantly, TEPCO did not follow up with sufficient alacrity on preliminary 2008 simulations that suggested the tsunami risk to the plant had been seriously underestimated. These simulations were not reported to NISA until March 7, 2011.*
- ***NISA Inattentiveness:*** *A fundamental principle of nuclear safety is the existence of an effective and independent regulator to set safety rules and to ensure compliance with them. Japan's regulators, however, appear to have been inattentive to tsunami risks. NISA failed to review simulations conducted by TEPCO and to foster the development of appropriate computer modelling tools[13]'.*

It is well recognised in foresight and reflective practices that the past is not an isolated static state, but one that is intimately connected with the future (MACKAY and MCKIEMAN, 2004). The Final Report and recommendations for the Fukushima nuclear accident highlighted:

> *The then-available accident preventive measures and disaster preparedness of TEPCO and NISA were insufficient against tsunami and severe accidents; the preparedness for a large-*

[11] http://www.dpri.kyoto-u.ac.jp/web_j/syokuin/saitoe/bumon_1e.php [Accessed on 6 Januray 2014] and http://www.rri.kyoto-u.ac.jp/en/research_div [Accessed on 6 January 2014]

[12] See http://carnegieendowment.org/files/fukushima.pdf [Accessed on 6 January 2014]

[13] See http://carnegieendowment.org/2012/03/06/was-fukushima-accident-preventable/c3ka [Accessed on 6 January 2014]

*scale complex disaster was insufficient; and they were unprepared for the release of a large amount of radioactive materials into the environment caused by a containment failure. Inadequate TEPCO emergency responses to the accident at the site were also identified. Furthermore, in the preventive measures against the spread of damage taken by the central and local governments, problems were identified which lacked consideration to the victims, such as the radiation monitoring operation, the utilization of the System for Prediction of Environmental Emergency Dose Information (SPEEDI), evacuation instructions to the residents, responses to the people's radiation exposure, or the provision of information to the nation and outside the country. In addition, problems of the crisis management system of the government came to light, too.*[14]

## Reflective Response and DRR

Reflective practice at the organizational level then allows members to

> *'…critically evaluate their own thinking, but also, to investigate the shared, collective assumptions and expectations, as well as the institutionalized rules and routines'* (HILDEN and TIKKAMAKI, 2013).

Within the context of DRR and NATECH, this provides a methodology to address many of the gaps identified regarding the hyper-risks. Reflective practices that support mindfulness affords organizations involved in DRR within the context of NATECH a "heightened awareness in critical and complex situations which require novel responses" (ZUNDEL, 2012). As described in WEICK and SUTCLIFFE (2001), mindfulness supports a preoccupation with failure and a reluctance to simplify interpretations, coupled with sensitivity to weak signals and the ability to respond locally and in real time. In this sense, reflection is about engaging in analysis, considering alternatives, seeing things from various perspectives to better understand the NATECH hyper-risks and potentially cascading effects.

Reflective practice is integral to shaping adaptation to emergent and dynamic realities in complex environments. PATTON (2011) highlights various applications of developmental evaluation and reflective practice that address the complexities associated with international development and capacity building initiatives through lessons learned and stakeholder engagement. This interpretive framework resonates with the application domain of DRR and in particular in unearthing the complexities associated with NATECH accidents and facilitating risk governance (CRUZ, 2012). As noted from the Fukushima case study and the studies on NATECH accidents conducted by CRUZ (2012) and KRAUSMANN and CRUZ (2013), the requirement to test and challenge assumptions, theories and ideas emerges as a key enabler

[14] See http://www.nirs.org/fukushima/SaishyuRecommendation.pdf [Accessed on 6 January 2014]

to support DRR. Within the context of DRR, reflective practice, as part of a developmental evaluation, embraces the complexity associated with such disasters involving NATECH and centres on

> *'[…] situational sensitivity, responsiveness and adaptation, and is an approach to evaluation especially appropriate for situations of high uncertainty where what may and does emerge is relatively unpredictable and uncontrollable'* (PATTON, 2011).

In this sense, reflective practice through a developmental evaluation framework

> *'[…] tracks and attempts to make sense of what emerges under conditions of complexity, documenting and interpreting the dynamics, interactions and interdependencies that occur as innovations unfold'* (PATTON, 2011).

What emerges from a reflective practice concerning NATECH is the realisation that the 'hyper-risks' that characterize the global complexities manifest themselves in local uncertainties. PATTON (2011) argues that

> '*from a big picture global system perspective, these complex phenomena are interconnected: economic, political, demographic, environmental, social, cultural, technological and health systems interlocked, interacting and interdependent with unknown and unpredictable consequences'*.

KRAUSMANN and CRUZ (2013) describe that the

> *'Tohoku disaster showed that even countries with high levels of earthquake preparedness are at risk of major NATECH accidents. This therefore offers an opportunity to assess the performance of existing NATECH prevention and mitigation measures and to learn lessons for a more far-reaching management of NATECH risk'*

to support resilience.

The NATECH accidents caused by the Great East Japan earthquake and tsunami clearly demonstrate the risk of cascading effects during natural disasters. Analysis conducted by KRAUSMANN and CRUZ (2013) highlight how such factors as

> *'[…] model uncertainties reflected in insufficient design and low levels of preparedness, overconfidence in existing safety measures, cost/benefit considerations, complacency or the violation of safety regulations'*

figured prominently in the NATECH disaster.

They further argue that

*'with Japan being a country generally considered well prepared for natural disasters, it is likely that preparedness levels in less developed countries will be even lower' (KRAUSMANN and CRUZ, 2013).*

This highlights the requirement for awareness regarding the interdependencies of NATECH accident and their subsequent cascading effects. CRUZ (2012) shows that although such awareness has improved, '…this is not reflected sufficiently in the laws and regulations of individual countries, and a general framework for the governance of NATECH risk is lacking'.

This brings one of the major caveats of reflective responses to the fore. Reflective responses are likely to encounter challenges at governmental and non-governmental organisations' with regard to time, bureaucracy and centralised decision making processes - all of which underpin power, politics and authority. Practitioners and communities of practice do not work in a social vacuum (ARGYRIS, 1960) and reflective practices can bring some of the nuances of messy businesses and power dynamics of bureaucracy and management to the fore through lack of awareness and in-actions (GARDNER et al., 2006 ; FOOK, 2004).

Nevertheless, according to PATTON (2011), reflective practice figures prominently in support of capacity building and here it is argued that it can support DRR. But greater awareness is required to address the gaps in addressing NATECH accidents. 'Awareness' is also a key factor for effective DRR (UNISDR, 2009). Hence, raising awareness through critical reflection has the potential to generate not only critical social agencies amongst the communities of practice but also growth conducive to development, adaptation and resilience at individual and organisational levels for hyper-risks and NATECH disasters.

## The Usefulness of Reflective Response in DRR

In light of the above discussions it is worth questioning the practical usefulness of reflective response. What can an organisation learn from reflective response? What value can it have to the communities of practice and management? This paper posits the following deduced from the case of Fukushima:

***Improve management practices and philosophy***

The lack of forethought given by the national government and the majority of local governments to the occurrence of a nuclear accident in the form of a complex disaster highlights the inadequacies in Japans' crisis management attitude, both in aspects of the safety of nuclear power plants as well as safety of the surrounding local communities.

As noted in the Executive Summary of the Final Report- Investigation Committee on the Accident at Fukushima Nuclear Power Stations of Tokyo Electric Power Company (2012)[15]:

> *TEPCO lacked a sense of urgency and imagination toward a major tsunami, which could threaten to deal a fatal blow to its nuclear power plants. Consequently this could be considered as one of significant background factors that led to a serious nuclear accident and inadequate measures against the expansion of damage[16].*

The increasing complexity of today's interconnected and interdependent systems as it pertains to DRR has resulted in calls for greater understanding and development mechanisms for coping with uncertainty and shocks to the system.

### *Developing human and organisational resilience to hyper-risks*

Strategic reflection creates an opportunity to share, compare and explore mental models thus opening up consideration of the variety of possibilities. Enabling resilience therefore requires a constant sense of unease that prevents complacency. As argued by HOLLNAGEL and WOODS (2006)

> *'...it requires a realistic sense of abilities of where we are. It requires knowledge of what has happened, what happens, and what will happen, as well as what to do. A resilient system must be proactive; flexible; adaptive; and prepared. It must be aware of the impact of actions, as well as the failure to take action'.*

Reflective practice has the potential to

1) Identify the sensitive and 'forgotten' areas of practices
2) Provide for the analysis of hesitation, skills and knowledge gaps
3) Provide relief from stress
4) Identify learning needs
5) Disseminate experience and expertise to and from colleagues and result in an increased confidence in professional practice (BOLTON, 2005).

Furthermore, reflective practices can lead to the elimination of 'second order errors[17]' of management (GOULD, 2004), latent errors and organisational breakdown (REASON, 1997; TOFT and REYNOLDS, 2005) and evolve, adapt and generate learning and leadership (BALDWIN, 2004; SENGE, 1990) to address the fast changing landscapes of hyper-risks and disasters in which organisations and communities of practice operate.

[15] http://www.cas.go.jp/jp/seisaku/icanps/eng/finalgaiyou.pdf [Accessed on 6 January 2014]
[16] http://www.cas.go.jp/jp/seisaku/icanps/eng/finalgaiyou.pdf [Accessed on 6 January 2014]
[17] Second order errors are those errors caused by management decisions.

### *Bridging the gap between theory and practice*

Of equally significant importance, reflective practices can lead to a reduction in the gap between theory and practice by informing theories based on messy practices (FOOK, 2004). This is explained in Fook's words:

> *'reflective practices can contribute to the possible improvement of practice by closing the gap between espoused theory and enacted practice; the learning of knowledge generating capacities; the potential for on-going evaluation of practice; and the integration of theory, practice and research' (FOOK, 1996; quoted in FOOK, 2004).*

The case of Fukushima illustrated these gaps.

Reflective practices are an on-going combination of reflection and critical reflection processes undertaken at workplaces, to meet the everyday organisational challenges. In the context of this paper, this was extended to comprehend hyper-risks and NATECH incidents. Reflective practices and reflective responses are a 'dynamic developmental process' (BOLTON, 2005). Similarly to reflective practice, mitigating hyper-risks is an on-going process. As a result, both mitigation and reflective practices are mutually inclusive. It is therefore posited that a combination of mitigation and reflective practices will enable disaster mitigation to attain a critical edge in order to progress the multi-disciplinary DRR concept and practice.

## Conclusion: A Charter for Critical Reflective Responses

To conclude, this paper has argued for 'reflective response' that is based on 'critical reflective practices' as a means with which to counter hyper-risks. The fundamental characteristic of today's world is the interconnectedness and interconnectivity that generates wealth as well as 'dangers' and 'bads' of the post-modern societies in conjunction with science. The landscape of risk society is highly vulnerable to social, natural and technical hazards. The dangers and 'bads' created from the combination of these hazards and hyper-risks are illustrated through the case of NATECH disasters in general and the case of Fukushima in particular.

The caveat of the dominant crisis and disaster theories and practices are that they fail to capture the complexities of the post-modern world and that of the organisations involved in DRR practices. Most importantly there is a lack of understanding on NATECH disasters and hyper-risks. Hyper-risks are embedded in complex processes. They are unpredictable with a likelihood of trans-border cascading effect. The case of Fukushima illustrated some aspects of hyper-risks.

To tackle hyper-risks, this paper has argued for developing organisational resilience by adopting 'reflective response'. Reflective response is understood as a combination of individual, collective and critical reflections and reflective strategies to build the capacity of learning organisations and that of the communities of practice. Reflective response is complementary to the dominant reactive and pro-active disaster responses.

Building organisational resilience is seminal in this hyper-connected world. The consequence of promoting only reactive and pro-active disaster responses was illustrated through the case of Fukushima. The case study also demonstrated the importance of adopting non-linear, complex mental models in order to prepare for the NATECH disasters embedded in hyper-risks. Currently, the dominant risk, crisis and disaster theories and practices are inadequate to offer a space to comprehend the true nature of hyper-risks and NATECH disasters. OZUNNU et al. (2011) argue:

> *'The consequences of these conjoint events are much more substantial for the health of people, environment and property than those posed by each hazard alone'.*

In this light a new paradigm is much needed to support the DRR practices worldwide.

To realise reflective response, a charter is suggested:

1. Include complexity/systems thinking in the HFA so that effective responses can be designed to address the complexity associated with conjoint NATECH disaster.
2. Promote more research and practice to understand 'hyper-risks' and NATECH incidents.
3. Adapt critical reflective practices through systems thinking and participatory action research.
4. Build the capacity of the communities of practice through individual, collective and critical reflection and reflective strategies. Tools of systems thinking can play a crucial role in this aspect.
5. Leverage the principles of High Reliability Organisations (WEICK AND SUTCLIFFE, 2007) to support mindfulness as part of the reflective practice.
6. Include organisational learning as a key tenet in support of organisations associated with NATECH risk management.

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