Complexity and Security: New Ways of Thinking and Seeing

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Abstract From the refugee crisis to economic slowdowns in emerging markets, from ever-rising numbers of terrorist and cyberattacks to water shortages and famines, global risks continue to dominate the headlines. The Asia-Pacific region in particular has the highest number of total occurrences, fatalities and effects of natural disaster events (flood and cyclone) and is no stranger to mega-disasters such as the likes of Super Typhoon Haiyan and Indian Ocean Tsunami of 2004. According to the World Economic Forum 'The world is insufficiently prepared for an increasingly complex risk environment' (WEF, Global Risks 2015 10th edn: insight report, 2015). The threats to human security that we face today are multiple, complex and interrelated and often mutually reinforcing. As such, 'Global risks cannot be seen in isolation' (WEF, Global Risks 2015 10th edn: insight report, 2015). The hyper-connected world we live in is underpinned by hyper or hybrid-risks, whereby '…the fragility and vulnerabilities lie within the social/technological/economic/political/ecological interdependent systems' (Masys AJ, Ray-Bennett N, Shiroshita H, Jackson P, Procedia Econ Financ 18:772–779, 2014). It is through these underlying networks that Helbing (Nature 497:51–59, 2013) argues that we have '… created pathways along which dangerous and damaging events can spread rapidly and globally' and thereby has increased systemic risks.

The Asia-Pacific region faces many human security challenges associated with meeting food, water, and energy requirements in scenarios that stress the human security 'ecosystem'. A Chatham House report 'Preparing for High Impact, Low Probability Events', found that governments and businesses remain unprepared for such events (Lee B, Preston F, Green G, Preparing for high-impact, low – probability events: lessons from Eyjafjallajokull. A Chatham House Report, London, 2012). This chapter presents the Asia-Pacific Security landscape as a complex 'ecosystem' that requires concepts, tools and perspectives from complexity theory, systems thinking and network science to support regional and global security risk management. The key is to embrace a strategic visioning and actioning that examines the interdependencies and interconnectivity across various 'actors' in the security ecosystem and how black swan events can stress the system. This is examined through

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the lens of Human security that lies at the center of the water-food-energy nexus as well as the disaster risk reduction, sustainability and development nexus.

Keywords Human security • Asia-Pacific • Complexity • Systems thinking • Network mindset

1 Introduction

As described in Masys (2016a, b), the threats and risks to security (both man-made and natural) are varied and impactful. The distinction between natural and man-made threats is being blurred and the inherent vulnerabilities transcend this perceived dichotomy. Disaster events such as Hurricane Katrina (2005), Hurricane Sandy (2012), Fukushima Daiichi nuclear meltdown (2011), Typhoon Haiyan (2013) and global terrorist events illustrate the devastating effects of natural and man-made disasters on human systems and human security (Masys et al. 2014).

The Asia-Pacific region in particular has the highest number of total occurrences, fatalities and effects of natural disaster events (flood and cyclone) and is no stranger to mega-disasters such as the likes of Super Typhoon Haiyan and Indian Ocean Tsunami of 2004. Data from United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) 2015 shows that in the past four decades there has been a growing number of small and medium-scale disasters which have resulted in a total loss of over US$1.15 trillion. This threat and risk landscape challenges regional security along such lines as: national security; energy security; water security; food security; health security; human security; environmental security; economic security.

As described in Prizzia and Levy (2017) '…in the wake of the September 11, 2001 terrorist attacks, security has become an existential concern for countries across the Asia-Pacific Region. The increasing intensity, complexity and frequency of security threats has caused governments, industries, NGOs, policy makers and communities throughout the Asia-Pacific societies to urgently re-assess their exposure to security risks and vulnerabilities, contributing to a transformation in our understanding and perception of security in the Asia-Pacific Theatre'. It is the inherent complexity of the security landscape that is driving the requirement for a more holistic and 'nexus' approach to security planning. Our strongly connected global networks have produced highly interdependent systems that challenge our security posture through a lack of understanding regarding them. Helbing (2013: 51) argues that:

> Many disasters in anthropogenic systems should not be seen as 'bad luck', but as the results of inappropriate interactions and institutional settings. Even worse, they are often the consequences of a wrong understanding due to the counter-intuitive nature of the underlying system behaviour. Hence, conventional thinking can cause fateful decisions and the repetition of previous mistakes. This calls for a paradigm shift in thinking: systemic instabilities

> can be understood by a change in perspective from a component-oriented to an interaction- and network-oriented view.

These comments certainly resonate within the security domain. Shocks (whether man-made or natural disasters) stress our 'security' ecosystem often resulting in failures at various scales thereby posing serious threats nationally, regionally and globally. We can define an ecosystem as an evolving and dynamic collection of actors which respond to its environment. This biological analogy emphasizes the interdependence of all actors in the environment who 'co-evolve their capabilities and roles'. Like natural **ecosystems**, the **security ecosystem** comprises a variety of diverse actors (human, physical and informational) as described in Masys (2016a) that interact in complex and dynamic ways. To better manage black swan events that stress the security ecosystem, a fundamental redesign of our mental models and perspective is needed: essentially a paradigm shift in how we view and enable security. 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 misinterpret new information that should force re-evaluation and revision of the situation assessment….

Given the current security landscape and shocks to human systems characterized by complexity and wickedness (Masys 2016a, b), 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 concept of resilience (supporting security) encompasses a capacity to anticipate and manage risks and the ability to survive threats and respond to challenges. The question becomes how do we conceptualize and manage security in the face of extreme events and black swans (Taleb 2007; Masys 2012a, b, c; Masys et al. 2015)? The paradigm shift of systems thinking and complexity provides some key insights.

2 Complexity

A Chatham House report 'Preparing for High Impact, Low Probability Events', found that governments and businesses remain unprepared for such events (Lee et al. 2012). The field of complexity science has provided alternative perspectives regarding non linear dynamics and greater understanding of underlying processes, interdependencies and interconnectivity of systems. This chapter introduces concepts, tools and perspectives from complexity theory, systems thinking and network science to support non-traditional security (crisis and disaster management).

As described in Masys (2007), complexity theory is an interdisciplinary field of research that provides a conceptual framework, a way of thinking and a way of

seeing the world. Complexity is associated with the notion of intricate intertwining or inter-connectivity of elements within a system and between a system and its environment. As such the inherent complexity of a system cannot be fully understood by simply studying its constituent parts. Cilliers (1998:2) remarks that 'a complex system is not constituted merely by the sum of its components, but also by the intricate relationships between these components. In cutting up a system, the analytical method destroys what it seeks to understand'. It has been shown in the literature across various domains of inquiry how small changes to a system can produce large effects. As applied to security, thinking in terms of complexity provides a perspective that reveals emergent properties, nonlinearity and a 'dynamic system' of interactions and interrelations. Managing threats and risks associated with security is no longer a state-centric exercise. Understanding the interdependencies and interconnectedness of the security ecosystem through a forensic analysis (Masys 2016a) is a requirement. Important features that characterize complex systems and their behavior include the ability to produce properties at the collective level that are not present when the components are considered individually as well as their sensitivity to small perturbations. This dynamic behavior of complex systems involves interactions at all scales. The acknowledgement of nonlinearity enables new views on causality and its temporal and spatial implications on security. 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.

3 Discussion: Asia-Pacific Security Landscape

3.1 Black Swan Events

The high impact and low frequency 'black swan' events are becoming the new normal in the Asia-Pacific region. The human security (freedom from want, freedom from fear) dimensions to black swan events are national and regional security challenges. As a 'security threat' such events '…disrupts the free flow of trade and investments across economies; and presents tremendous challenges and serious threats to the inclusiveness and sustainability of growth and development in the region. As per the World Bank estimate, the APEC economies have incurred disaster-related losses of over $100 Billion every year for the last ten years' (APEC 2015). Events like the Great East Japan Earthquake and Typhoon Haiyan characterize these events. Lixin et al. (2012:295) in their analysis of the disaster management system in China argue that 'China has been traditionally vulnerable to almost all natural disasters because of its vast territory, and complicated weather and geographical conditions. Almost all kinds of natural disasters, such as floods, droughts, earthquakes, typhoons, heavy snows, landslides and so on, have occurred every year (National Disaster Mitigation Center Disaster Information Department 2009).

These disasters induced serious losses. Generally, thousands of people die of these natural disasters, and about 200 million people are affected every year'. Such events have a significant impact on the security landscape (i.e. food security, energy security, health security) and signal opportunities for regional collaboration and cooperation with regards to disaster risk reduction and disaster management.

3.2 Understanding Disaster Forensics

As described in Masys (2016a), many large-scale disasters have a complex aetiology that transcends the reductionist, siloed perspective. They cannot be solved by technical approaches alone, but require an understanding of the collective 'social' dynamics. The 'social' here is used within the context of Actor Network Theory (ANT) as described in Masys (2010). This Latourian 'social' (Latour 2005:5) is defined as '… a 'trail of associations'. In this sense he describes the 'social' not as a designated thing among other things, but rather as a '…type of connection between things that are not themselves social'. It is these interdependent and interconnected 'actors' and the inherent relational dynamics that characterize the complexity. Such approaches as foresight, disaster forensics and network analysis support the opening of the black box of complexity (Masys 2010, 2012a, b, c, 2016a, b).

It is evident from the literature (Helbing 2013; Levine et al. 2011; Masys 2012a, b, c; Wattie and Masys 2014; Masys et al. 2014) that often policies and managerial decisions miss the mark with regards to crisis management and resilience and do not achieve desired outcomes, but actually lead to unexpected or unintended consequences (Masys 2012a, b, c). For example, Agyepong et al. (2012:iv22) argues that 'Policy resistance describes the situation in which the attainment of the goal of an intervention within a CAS is thwarted by the response of the system to the intervention itself. It arises from a 'narrow, reductionist world view' and a related 'mismatch between the complexity of the systems we have created and our ability to understand them' (Sterman 2006). A decision, action, inaction or some other intervention within a system, acts as a tipping point or trigger that leads to a response by another actor or group of actors. This response can be intended, unintended or a mixture'.

The same problems extend to the security domain. The issue stems from the complexity associated with the problem space of security whereby linear and 'siloed' thinking are too simplistic for 'security ecosystems' that are complex. Dekker et al. (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'. This is the realm of 'disaster forensics': understanding the complex aetiology of intended and untended consequences.

Table 1 Top five global risks for 2016 and 2017 in terms of likelihood and impact (WEF 2017)

Top 5 Global Risks in terms of likelihood		Top 5 Global Risks in terms of impact	
2016	2017	2016	2017
Large-scale involuntary migration	Extreme weather events	Failure of climate change mitigation and adaptation	Weapons of mass destruction
Extreme weather events	Large-scale involuntary migration	Weapons of mass destruction	Extreme weather events
Failure of climate change mitigation and adaptation	Major natural disaster	Water crises	Water crises
Interstate conflict with regional consequences	Large scale terrorist attacks	Large-scale involuntary migration	Major natural disasters
Major natural catastrophes	Massive incident of data fraud/theft	Severe energy price shock	Failure of climate change mitigation and adaptation

3.3 Threat and Risk Landscape

The Asia-Pacific security landscape is not just a regional concern. It is affected and affects the global risk landscape. The top five global risks for 2016 and 2017 in terms of likelihood and impact respectively are outlined in Table 1.

These risks and threats certainly resonate with the Asia-Pacific Region and contribute to a complex security environment. As noted in Staniforth (2016:11) '…the range of threats to national security is becoming increasingly complex and diverse. Terrorism, cyber-attack, unconventional attacks using chemical, nuclear or biological weapons, as well as large scale accidents or natural hazards…could put citizen's safety in danger while inflicting grave damage to a nation's interest and economic well-being'. The Asia-Pacific region is under constant stresses from the impacts of natural hazards and man-made disasters thereby affecting vulnerable populations. The links between disasters, development, sustainability and poverty are not new. Extreme poverty characterizes much of the vulnerable populations within Asia and the Pacific region. Zoraster (2010) argues that '…many high-risk geographical areas have a disproportionately high percentage of marginalized populations; this same population is at a disadvantage for preparation, evacuation, response, and recovery'. Within the Philippines for example, over 25 per cent of the population are living below the poverty line. This characteristic marks a considerable vulnerable population in the face of such disaster events as Super Typhoon Haiyan. Across Asia and the Pacific 772 million people live on less than $1.25 a day and are particularly vulnerable to disasters. They tend to live in low-value, hazardprone areas – not just city slums, but also steep slopes, seismic zones, floodplains and river banks or remote areas (UNESCAP 2016: XXIII). Human security framed along the lines of disaster risk reduction and resilience has acquired a renewed sense of urgency in the context of sustainability, development and poverty eradication.

Fig. 1 DRR, development and sustainability nexus

Development, sustainability, disaster risk reduction are inextricably linked and interdependent. At the center of this nexus (Fig. 1) lies human security (freedom from want, freedom from fear). Disaster risk reduction is a core development strategy amongst the 17 Sustainable Development Goals. For example as described in UNISDR (2015):

> Goal 1:
> Building disaster resilience is critical to achieving the goal of eradicating extreme poverty. As one of the key drivers of disaster risk, given the way it creates and aggravates economic and social vulnerability, poverty has significantly contributed to the growth in risk conditions which further limit the progress of sustainable development. Evidence suggests that the impacts of disasters undermine hard-earned development gains in both developing and developed countries, potentially dragging the poor and most vulnerable even deeper into poverty.
>
> Goal 8:
> Investing in disaster risk reduction and resilience is imperative to secure economic growth and development. Developed and developing countries alike have achieved significant economic progress over the years, yet the threat of increasing disaster risk raises uncertainties about their economic stability. This is due to the growing exposure of economic assets and people to hazards such as earthquakes, floods, hurricanes and drought, which magnifies disaster risk. Global average annual losses from disasters are forecast to increase from US$260 billion in 2015 to US$414 billion by 2030.

3.4 Water-Food-Energy Nexus

The Asia-Pacific Region is characterized as one of the world's most dynamic regions with regards to population growth, economic progress, urbanization, and industrialization. These factors have contributed to the demand for resources (food, water, energy) (Rasul and Sharma 2016: 689) and pose significant security concerns. The

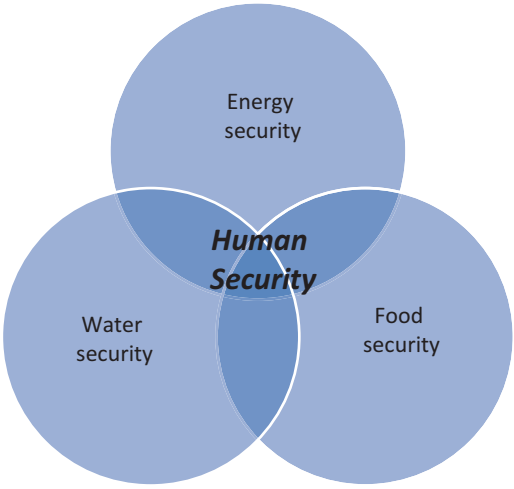

Fig. 2 Water-energy-food nexus

food-water-energy nexus (Fig. 2) is relevant to human security and resonates with issues pertaining to poverty and vulnerable populations. Lack of understanding of this nexus can lead to unintended consequences. Water-Food-Energy nexus emerges as a critical security concern in the face of black swan events. Sourced from the World Water Development Report 2014 (UN Water 2017):

> The global community is well aware of food, energy and water challenges, but has so far addressed them in isolation, within sectoral boundaries. At the country level, fragmented sectoral responsibilities, lack of coordination, and inconsistencies between laws and regulatory frameworks may lead to misaligned incentives. If water, energy and food security are to be simultaneously achieved, decision-makers, including those responsible for only a single sector, need to consider broader influences and cross-sectoral impacts. A nexus approach to sectoral management, through enhanced dialogue, collaboration and coordination, is needed to ensure that co-benefits and trade-offs are considered and that appropriate safeguards are put in place.

For the energy sector in particular Sharifi and Yamagata (Sharifi and Yamagata 2016:1655) argue that '…climate change and global warming can have negative impacts on energy sector through increasing energy demand and intensifying extreme events that threaten the security of the generation, transmission, and distribution infrastructure'. Such security threats as climate change can result in '…multiple stresses, and adaptation requires comprehensive and integrated approaches, with coordination between different sectors and at different scales (local, national, and regional). Water, energy, and food are critical for human survival and sustainable well-being. All three are subject to rapidly growing global demand, and all face resource constraints, with billions of people lacking access to them (Bazilian et al. 2011). Clearly, meeting these critical needs represents the most important challenge facing society today' (Rasul and Sharma 2016: 683).

Within this mindset and in particular within the context of human security, water-food-energy nexus and the security ecosystem, it is recognized that there exists a

disproportionality of 'causes and effects', in which as Urry (2002:59) remarks, past events are never 'forgotten'. 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 (Xu and Masys 2016) 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 consideration of the DRR, sustainability and development nexus, Rasul and Sharma (2016:689) capture some of the key principles associated with systems thinking to support the water-food-energy security:

- 'Understand the interdependence of subsystems within a system across space and time and focus on system efficiency rather than the productivity of individual sectors to provide integrated solutions that contribute to water, energy, and food policy objectives.
- Recognize the interdependence between water, energy, and food and promote economically rational decision making and efficient use of these resources in an environmentally responsible manner.
- Identify integrated policy solutions to minimize trade-offs and maximize synergies across sectors and encourage mutually beneficial responses that enhance the potential for cooperation between and among all sectors, and public–private partnership at multiple scales.
- Ensure policy coherence and coordination across sectors and stakeholders to build synergies and generate co-benefits to produce more with less and contribute to long-term sustainability with limited environmental impact.
- Value the natural capital of land, water, energy, and ecosystems and encourage business to support the transition to sustainability'.

To support security planning, the complex interplay of food, energy, and water demand and supply requires a holistic approach and institutional mechanisms to coordinate the actions and strengthen complementarities and synergies among the three sectors (Rasul and Sharma 2016: 696). Traditional linear thinking approaches are no longer valid. Agenda 2030 represents a transformational vision for dealing with human security. This can be addressed through a systems (nexus) approach associated with Disaster Risk Reduction, Development and Sustainability (Fig. 1).

Understanding the implications of these security challenges for the Asia-Pacific region has already reified with the 'black swan' shocks over the last number of years. 'New ways of thinking' are required (if not essential) to manage the complex problems associated with security management within this dynamic security eco-

system. As an integrating element, complexity theory provides not a methodology per se, but rather 'a conceptual framework, a way of thinking, and a way of seeing the world', and presents itself as a powerful way to view the security management domain. As presented with the nexus approach regarding water-food-energy security, complexity theory suggests that studying the interdependencies and interactions among the elements, as well as the unity of the system itself will provide critical insights to better manage shocks to the security ecosystem. Causal attribution moves beyond the traditional linear lens to reveal a more complex non-linear causality. Such an approach applying Actor Network Theory is detailed in Masys (2014, 2015, 2016a, b). Peters (2014) describes system thinking theories, methods and tools that can be applied to manage black swans within the security ecosystem.

3.5 New Ways of Seeing and Thinking

Disaster risk reduction (DRR) is an integral part of sustainability and development and is recognized as such in the Hyogo Framework for Action 2005–2015. The Sendai Framework for Disaster Risk Reduction 2015–2030 reaffirms and builds upon these key elements of sustainability and development.

DRR, sustainability and development figure prominently and are foundational elements for supporting human security. With regards to human security in the Asia-Pacific region, energy security is a key national security concern. Having reliable, safe and available energy is critical to support national economic and societal prosperity and innovation. Many countries throughout the Asia-Pacific region are natural resources deficient thereby challenging their energy security posture. For example in 2014 Japan imported more than 90 per cent of its primary energy supply, making energy security a major concern. The events following the Great East Japan Earthquake and tsunami of 2011 and subsequent nuclear disaster at Fukushima (Masys et al. 2014) capture the complexity and interdependencies of the security ecosystem. Within this complexity paradigm, risk is no longer localized but has become differentially distributed (borderless risk) thereby requiring society to deal with persistent insecurities and uncertainties nationally, regionally and globally. With the water-food-energy nexus, the challenges regarding energy security cascade across all three dimensions.

According to Helbing (2013:51) we are increasingly living in a 'hyper-connected world' which creates 'hyper-risks' because of numerous networks and interdependencies. When we consider this 'hyper-connected world', networked risks emerge thereby challenging our understanding regarding the defence, security and safety domain. As described in Masys (2014), in this 'hyper-connected world' with interconnected social/technical/political/economic systems, shocks to regional, national and global systems stemming from natural hazards, acts of armed violence, terrorism and transnational crime have significant defence and security implications. For

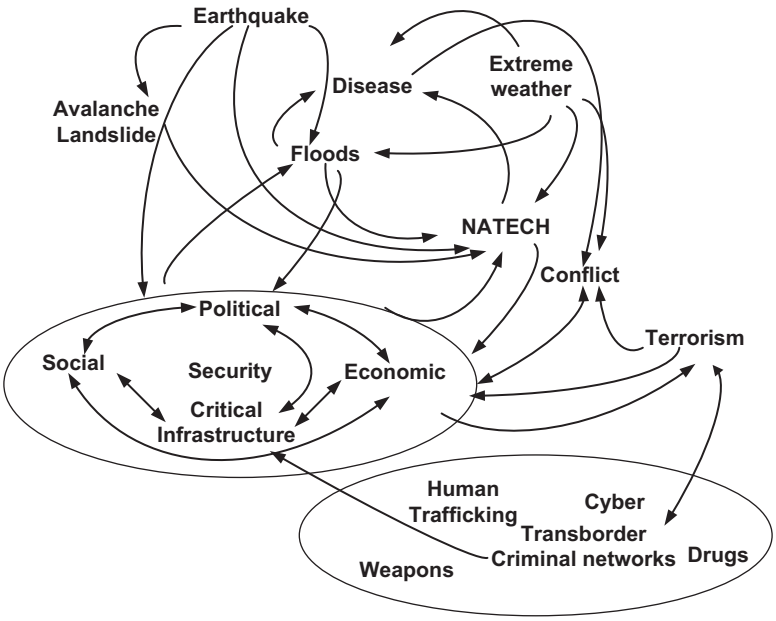

Fig. 3 Security ecosystem influence diagram

example, the local, regional and global supply chain security effects are reflected by Prizzia and Levy (2017):

> A rising sea level, for a country like Vietnam, with 2,000 miles of coastline presents a major environmental and food security challenge, especially in the Mekong River Delta region where 22 percent of the population lives and about half of the country's food is produced. With rising seas, millions of people in the Mekong Delta region will likely be forced to move. For the region's farmers, climate change has enormous implications, as Vietnam is an important player in the global food system. It is the second-largest producer of coffee, a crop grown in the highlands and that is affected by higher temperatures and rainfall pattern changes. Rice is their second-largest export commodity. They also export tea, pineapple, citrus fruit and sugar….

The complexity and dilemmas that characterize the security ecosystem (Fig. 3) requires a paradigm shift: a shift in the way we see; a shift in the way we conceptualize; a shift that recognizes the inherent interconnectivity and interdependencies. Such a shift challenges a reductionist approach and embraces a systems thinking paradigm. The paradigm of systems thinking permits a view of the world as a complex system in which as noted by Sterman (2000:10) we come to the understanding that 'you can't do just one thing' and that 'everything is connected to everything else'. This is supported by Senge (1990:73) who is of the opinion that the discipline of the systems approach lies in a shift of mind: in seeing interrelationships rather than linear cause-effect chains and seeing processes of change rather than snapshots.

The security ecosystem can leverage lessons learned from Typhoon Haiyan and other humanitarian and crisis management events (Masys 2012a, b, c). A systems lens reveals striking insights and solutions by helping to frame the problem across the DRR, Sustainability and Development nexus (Morgan 2005:15–16):

- 'First, people see the part to which they are connected but are largely unaware of the bigger system(s) that surrounds it. They miss their impact on others and others on them.
- Second, people tend to lack a time dimension. They see the present but not the past. They are intent on figuring out where a particular system should be in the future. They have some interest in knowing where it is now. But they have little inclination to understand where it has been. They do not know the history of the present. '…everything that was left unprepared becomes a complex problem, and every weakness comes rushing to the forefront' (Weick and Sutcliffe 2007)
- Third, participants miss - and in many cases mischaracterize - many of the key relationships that shape events.
- Fourth, people suffer from process blindness. They do not grasp the process dynamics, especially the deeper ones that are ongoing even within smaller systems. They suggest improvements which do not fit or even acknowledge the way the system actually works. They see individuals or events but not the processes of which they are a part'.

These key insights help to support the paradigm shift to systems thinking, complexity and nexus thinking. Levine et al. (2011: 7) argue 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'.

As shown in Fig. 3, the security ecosystem is integrated into the greater societal system showing how it influences and is influenced by disasters (both man-made and natural). Decisions displaced in time and space regarding security and disaster management can have significant implications as we have seen with the Fukushima nuclear accident and resulting stress on energy security for Japan and globally (Masys et al. 2014; Masys 2016b). A disaster forensics approach described in Masys (2016a) can help to unearth the complex interdependencies and identify key leverage points to support DRR, sustainability and development.

The mental models we have regarding security incorporate ones biases, values, learning, experiences and beliefs about how the world works. As described by Masys (2012b) with reference to the oil and gas industry safety culture, several processes through which mental models become flawed in industrial settings, resulted in the misreading of situations (Chapman and Ferfolja 2001) which resonates with security management and the lessons learned from various disasters. These processes include '… retaining outdated knowledge that no longer applies, accepting unreliable sources of information at face value, and missing out on critical

data because of poor communication within the work organization' (Chapman 2005). As Weick and Sutcliffe (2007) argue within the context of organizations:

> … Expectations are built into organizational roles, routines, and strategies. These expectations create the orderliness and predictability… Expectations, however, are a mixed blessing because they create blind spots. Blind spots sometimes take the form of belated recognition of unexpected, threatening events. And frequently blind spots get larger simply because we do a biased search for evidence that confirms the accuracy of our original expectations.

What this shows through the complexity lens is that the security ecosystem is shaped by factors seeded in advance. Recognizing this presents an opportunity for new strategic possibilities regarding security management across the DRR, Sustainability and Development nexus that enables resilience (Masys 2014). Urry (2002:59), in his discussion of complexity and systems, remarks that there exists a '…profound disproportionality of 'causes and effects'. Such systems possess a history that irreversibly evolves and in which past events are never 'forgotten'. Failure to recognize or understand the complex interdependencies associated with the security ecosystem can result in making incorrect assumptions regarding attribution and contribution of events and decisions. Local actions and decisions can have regional and global impacts. When we consider economic security within our security ecosystem, the lessons learned from the 2007/2008 financial crisis resonate with the requirement for a systems view. Goldin and Mariathasan (2014:33) argue that '… one reason for the failure to identify and contain the financial crisis 2007/2008 in a timely manner was that the approach to governance was largely guided by thinking in linear and one-dimensional relationships. In a complex and highly nonlinear world, such thinking generates unintended consequences'. The global financial crisis which began in 2007 had '…triggered losses of $4.1 trillion with its effects felt in every global market' (Goldin and Mariathasan 2014:24). The importance of systemic thinking crosses the security landscape from cyber to mass migration, from epidemics to natural disaster triggered technological disasters. As noted in Goldin and Mariathasan (2014:66) 'systemic analysis must examine nodes, pathways, and the relationships between them, because catastrophic changes in the overall state of the system can ultimately derive from how it is organized- from feedback mechanisms within it and from linkages that are latent and often unrecognized'. This has been described in detail in Masys (2016a) leveraging Actor Network Theory to support disaster forensics.

When we consider lessons learned, Dekker (2011: 40) reminds us that 'everything that can go wrong usually goes right, and then we draw the wrong conclusions'. His statement resonates with the security management domain. Addressing the unique challenges associated with such inherent complexity requires collaborative efforts among key disaster management and security stakeholders that facilitate questioning judgments and underlying assumptions, and employing critical and creative thinking (Xu and Masys 2016; Strang and Masys 2015) in order to explore the new strategic possibilities.

In addition to systems thinking and network thinking described in Masys et al. (2014) and Masys (2015), foresight and scenario planning (Masys 2012c) emerge as

key solution navigators with regards to shocks to the security ecosystem. Much of the challenges associated with managing shocks stems from the mind being '… blinded by optimism and confusion' or '…using out of date and unrealistic models of the world' (Ramo 2009:6). Leveraging alternative perspectives and system lenses provides insight to guide possible options based on defensible conclusions derived from evidence-centered research. Across management and applicable to DRR, Sustainability and Development, '…The most common source of mistakes is not the failure to find the right answers. It is the failure to ask the right questions. Nothing is more dangerous in business ***(or security)*** than the right answers to the wrong questions' (Ramirez and Wilkinson 2016:23).

The DRR, Sustainability and Development nexus and Water-Food-Energy nexus illustrates the human security implications of linear 'siloed' thinking. Systems thinking concepts are well known in the fields of biology, anthropology, physics, psychology, mathematics and computer science, and are beginning to gain impact in humanitarian, security and disaster management domains. In these domains, systems thinking constitutes a paradigm shift from the traditional linear way of thinking to a more dynamic and holistic perspective that embraces non linear behavior. Decision makers in these domains need to better understand the systems view to be able to tackle the wicked problems associated with the security ecosystem and black swan events.

4 Conclusion

Security management begins well before the disaster event (man-made or natural). Weick and Sutcliffe (2007:2) highlight how such an event can be '…considered as an abrupt and brutal audit: at a moment's notice, **everything that was left unprepared becomes a complex problem, and every weakness comes rushing to the forefront'**. Security can be challenged by the disruptive influences of climate change, public health outbreaks, food (distribution) shortages, financial crashes, cybercrime, natural and man-made disasters. As described in Masys (2015), in today's complex security environment we '…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 (Rosenhead and Mingers 2001: 4–5).

The APEC leaders, in their past declarations and statements, have expressed their commitment to address natural disasters, which remains as one of the major challenges confronted in the region (APEC 2015). Such a collective and collaborative leadership posture positions the Asia-Pacific well in addressing black swan events affecting security (national, regional and global). To support this regional effort, this chapter argues for the paradigm shift in ways of thinking and seeing to support security planning and awareness exploring the DRR, Sustainability, Development human security issues. The complexity associated with the Asia-Pacific security ecosystem certainly supports this paradigm shift.

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